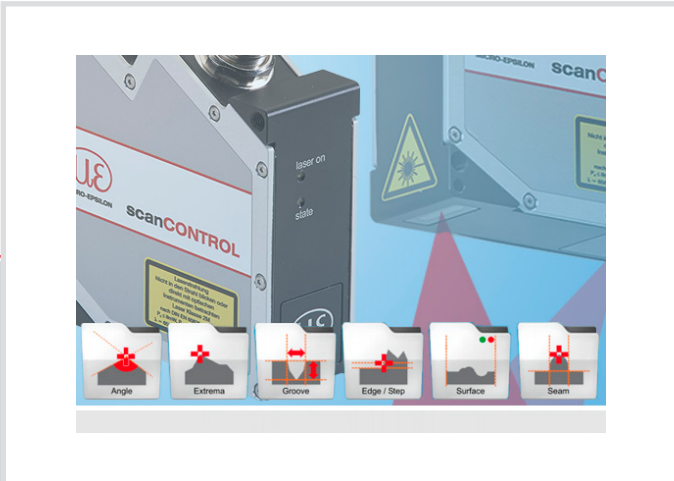




Operating Instructions



scanCONTROL Configuration Tools 6.8

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1. Introduction

This user manual gives an overview of the functions of the "scanCONTROL Configuration Tools" software, referred to in short as Configuration Tools in the following. This provides you with the possibility to configure and parameterize the scanCONTROL measurement system for your measurement task in order to examine and solve typical measurement tasks with it. The scanCONTROL measurement system is a laser line sensor which is designed for applications in the industrial environment.

This product is characterized by high speed and accuracy of measurement. Configuration Tools provides you with ways to solve different applications combined with maximum precision.

The scanCONTROL measurement systems are split into three product series. The following types of sensors are available:

- **scanCONTROL Compact:** Laser scanner for customer's own integration:
 - scanCONTROL 2500-25/2500-50/2500-100
 - scanCONTROL 2600-25/2600-50/2600-100
 - scanCONTROL 2700-25/2700-50/2700-100
 - scanCONTROL 2900-10/2900-25/2900-50/2900-100
 - scanCONTROL 3000-25/3000-50/3000-100/3000-200/3000-430/3000-600
 - scanCONTROL 3002-25/3002-50/3002-100/3002-200/3002-430/3002-600
- **scanCONTROL High-Speed:** Laser scanner with particular high measuring rates:
 - scanCONTROL 2650-25/2650-50/2650-100
 - scanCONTROL 2750-25/2750-50/2750-100
 - scanCONTROL 2950-10/2950-25/2950-50/2950-100
 - scanCONTROL 2657-25/2657-50/2657-100
 - scanCONTROL 3050-25/3050-50/3050-100/3050-200
- **scanCONTROL Smart:** Laser scanner with integrated profile calculation for measurement tasks:
 - scanCONTROL 2510-25/2510-50/2510-100
 - scanCONTROL 2610-25/2610-50/2610-100
 - scanCONTROL 2660-25/2660-50/2660-100
 - scanCONTROL 2710-25/2710-50/2710-100
 - scanCONTROL 2760-25/2760-50/2760-100
 - scanCONTROL 2910-10/2910-25/2910-50/2910-100
 - scanCONTROL 2960-10/2960-25/2960-50/2960-100
 - scanCONTROL 3010-25/3010-50/3010-100/3010-200/3010-430/3010-600
 - scanCONTROL 3012-25/3012-50/3012-100/3012-200/3012-430/3012-600
 - scanCONTROL 3060-25/3060-50/3060-100/3060-200
 - gapCONTROL 2611-25/2611-50/2611-100
 - gapCONTROL 2661-25/2661-50/2661-100
 - gapCONTROL 2711-25/2711-50/2711-100
 - gapCONTROL 2761-25/2761-50/2761-100
 - gapCONTROL 2911-10/2911-25/2911-50/2911-100
 - gapCONTROL 2961-10/2961-25/2961-50/2961-100

Note: In the following the term scanCONTROL stands for all measurement systems listed above.

1.1 Using this Manual

The user manual contains general information on the installation and use of Configuration Tools and on the use of the scanCONTROL measurement system. As a user of the software it is important that you read Chapter 2 "[Installation and Preparation for Measurement Operation](#)". Chapter 3 "[Working with scanCONTROL Configuration Tools](#)" and Chapter 4 "[Description of the Measuring Programs](#)" explain how to use the functions offered by the software. Chapter 5 "[Combining Results from Measuring Programs](#)" describes how to combine measured values. In Chapter 6 "[Filtering and Evaluating Measured Values and Configuring Outputs](#)" you will find a description about filtering measured values and configuring the output ports of scanCONTROL Smart. Chapter 8 "[Working with the scanCONTROL Smart Measurement System](#)" describes how to use the scanCONTROL Smart product series.

Note: Please refer to the contact address printed on the inside cover for any issues relating to queries and support or any other technical information.

1.2 Overview of the Complete System

scanCONTROL Configuration Tools transfers profile data from the scanCONTROL measurement system in a simple way and displays these graphically. These profile data are further processed and evaluated in measuring programs. All data are transferred via Ethernet, and can be stored with the software if needed. Depending on the measurement system used, scanCONTROL Configuration Tools is used as follows.

- **scanCONTROL Compact/High Speed:** The scanCONTROL measurement system measures two-dimensional profile data and transfers them to the PC. Configuration Tools evaluates the profile data, determines measured values and evaluates them.
- **scanCONTROL Smart:** The scanCONTROL measurement system measures two-dimensional profile data, evaluates the profile data, determines measured values and evaluates them. The measured values are output at various ports (see below). Configuration Tools is used for parameterization of the measurement system and for the visualization of the measurement results. If the parameterization has been completed, the software can be closed and the measurement system can be disconnected from the PC. The scanCONTROL Smart measurement system then continues to operate as an independent unit and performs the measurements.

	scanCONTROL 25X0/26X0/29X0/30XX	scanCONTROL 27X0
RS422 (ASCII format, binary)	half-duplex	full-duplex
RS422 (Modbus RTU protocol)	half-duplex	full-duplex
Ethernet (UDP, ASCII format, binary)	yes	yes
Ethernet (Modbus TCP protocol)	yes	yes
Analog out	4 x *	4 x *
Digital out	8 x *	8 x *
ProfiNET	yes **	yes **
Ethernet/IP	yes **	yes **
EtherCAT	yes **	yes **

* optional, 2D/3D Output Unit is required

** optional, 2D/3D Gateway is required

Fig. 1.1: Measured values output ports

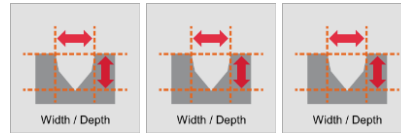
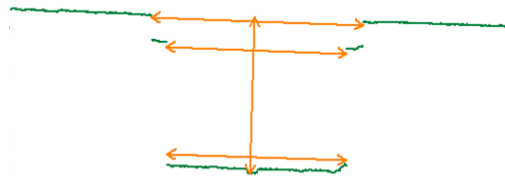
Function
Data transmission via scanCONTROL (online operation)
Loading a stored profile sequence (offline operation)
Visualization of measurement results
scanCONTROL parameterization
Synchronization (triggered operation)
Filter functions
Restore factory settings
Load scanCONTROL parameters offline
Offline logging of measurement results
Loading and saving parameters
Store parameters permanently on scanCONTROL *
Read parameters from scanCONTROL *
Statistical evaluation of measured values
Calibration of the mounting position
Select language
Select unit (mm, μ m, inch)
Online logging of measurement results
Output of the measured values
Output of the profile data

* In order to store and read all measurement parameters please use the scanCONTROL Smart product series. In case of using the scanCONTROL Compact or scanCONTROL High-Speed product series, only a subset of the parameters is stored/read (see Chapter 3.14.4 and 3.14.5).

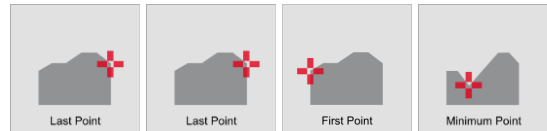
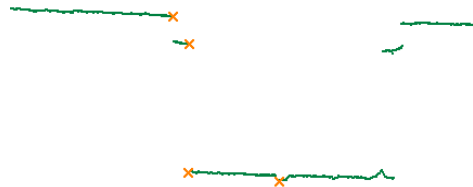
Fig. 1.2: Functional scope of scanCONTROL Configuration Tools

1.3 Application Examples for scanCONTROL Smart

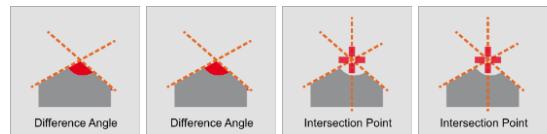
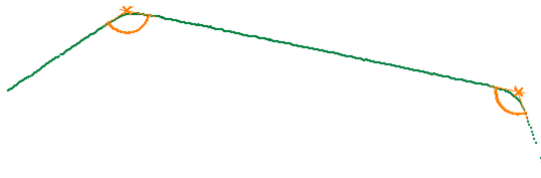
The following are just some examples of measuring tasks for which scanCONTROL Smart is designed (On the right the measuring programs needed for solving the respective measuring task are illustrated):



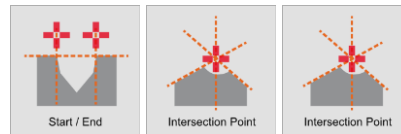
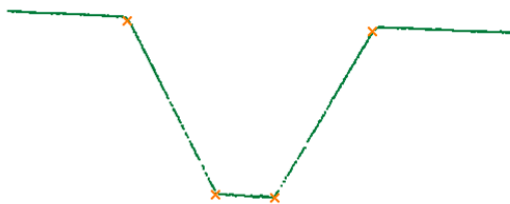
Width at several positions



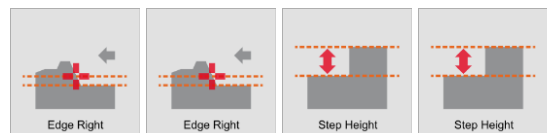
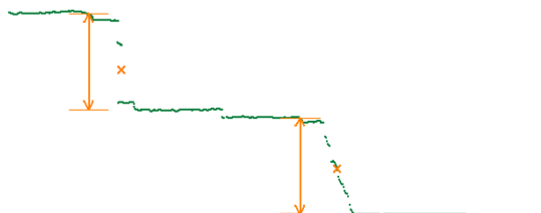
Several extreme values



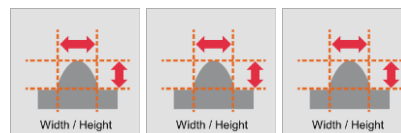
Angles and intersections



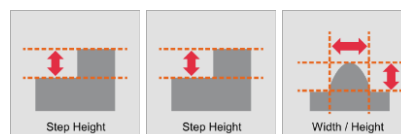
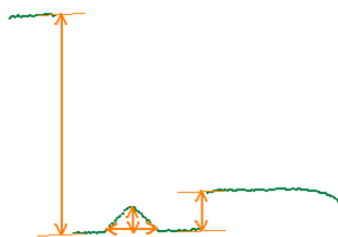
Features of a v-profile



Positions and step heights



Height and width of several profile sections



Several geometric data (1)

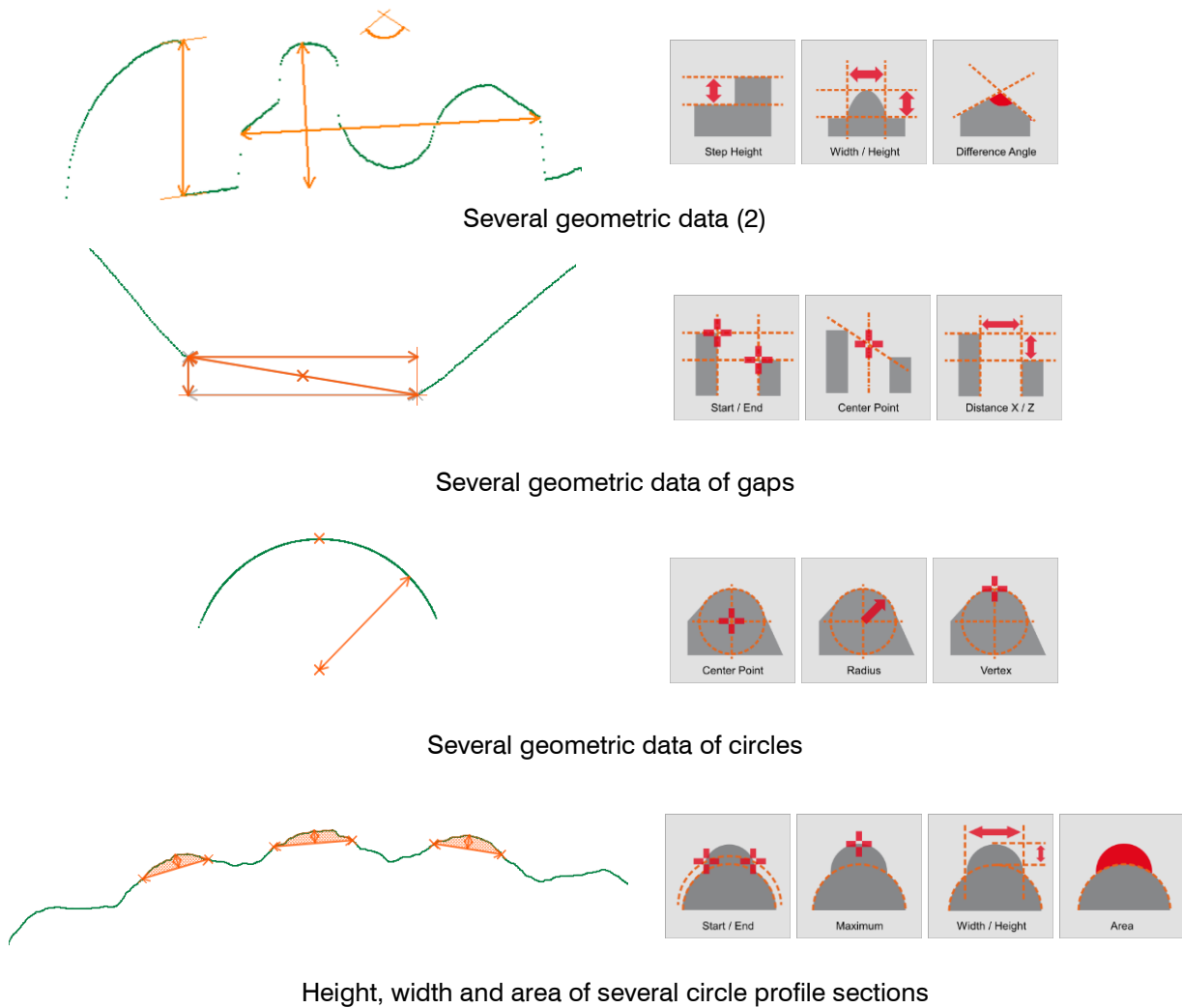


Fig. 1.3: Examples of applications

1.4 Definition of Basic Terms

- **Profile:** A profile consists of a maximum of 2048 individual measuring points. Each of these points is defined by its X and Z coordinate.
- **X coordinate:** The horizontal coordinate of a point.
- **Z coordinate:** The vertical coordinate of a point.
- **Profile sequence:** A chronologically consecutive series of profiles is called a profile sequence.
- **Measurement operation:** This describes the operation in which a profile is scanned by scanCONTROL Smart and all the measured values are determined.
- **Series of measurements:** A chronologically consecutive series of measurement operations is called a series of measurements.
- **Scan rate:** This refers to the number of measurement operations performed per second.

1.5 Functions of the Measuring Programs

This list of functions should only be used as a brief overview. The measuring programs are split into 11 groups. A detail description of all measuring programs can be found in Chapter 4.

- Extrema: Programs for determining extreme values can be found in this group.
 - Maximum Point: Determination of the point with maximum Z coordinate.
 - Minimum Point: Determination of the point with minimum Z coordinate.
 - First Point: Determination of the point with minimum X coordinate.
 - Last Point: Determination of the point with maximum X coordinate.
- Angle: Programs for angle measurement can be found in this group.
 - Absolute Angle: Determination of the angle of a straight line to the X axis.
 - Absolute Angle / Offset: Determination of a straight line and calculation of the offset and the angle to the X axis.
 - Double Angle: Determination of two independent straight lines and calculation of the respective angle to the X axis.
 - Difference Angle: Determination of two independent straight lines and calculation of the angle between the two lines.
 - Intersection Point: Determination of two independent straight lines and calculation of the coordinates of the intersection point between both lines.
- Edge/Step: Programs for edge and step measurement can be found in this group.
 - Single Offset: Determination of a straight line and calculation of the offset of the line.
 - Double Offset: Determination of two independent straight lines and calculation of the offsets of the lines.
 - Step Height: Determination of the height of a step.
 - Edge Left: Determination of the position of a rising or falling edge with an edge orientation from left to right.
 - Edge Right: Determination of the position of a rising or falling edge with an edge orientation from right to left.
- Surface: Programs for surface inspection can be found in this group.
 - Deviation: Determination of a straight line and calculation of the number of points and the average deviation of the points from the line.
 - Double Deviation: Determination of two independent straight lines and calculation of the average deviation of the points from the respective line.
 - Surface Maximum: Determination of a straight line and calculation of the distance and the X coordinate of the point with maximum positive distance from the line.
 - Surface Minimum: Determination of a straight line and calculation of the distance and the X coordinate of the point with maximum negative distance from the line.
- Seam: Programs for inspecting heightenings, for example of beading or welds, can be found in this group.
 - Start/End: Determination of a heightening and calculation of the X coordinates of the start and end point.
 - Maximum: Determination of a heightening and calculation of the coordinates of the point with maximum height.
 - Width/Height: Determination of a heightening and calculation of its width and height.
 - Area: Determination of a heightening and calculation of its area
- Groove: Programs for inspecting deepenings, for example of a groove or a gap, can be found in this group.
 - Start/End: Determination of a deepening and calculation of the X coordinates of the start and end point.
 - Minimum: Determination of a deepening and calculation of the coordinates of the point with maximum depth.
 - Width/Depth: Determination of a deepening and calculation of its width and depth.
 - Area: Determination of a deepening and calculation of its area.
- Gap: Programs for inspecting gaps.
 - Start/End: Determination of a gap and calculation of the X coordinates of the start and end point.
 - Center Point: Determination of a gap and calculation of the coordinates of the center point.
 - Distance X/Z: Determination of a gap and calculation of the distance between its start and end point in X and Z direction.

- Circle: Programs for inspecting circles.
 - Center: Determination of a circle and calculation of the X and Z coordinates of the center point.
 - Radius: Determination of a circle and calculation of the radius.
 - Vertex: Determination of a circle and calculation of the vertex.
- Circle Seam: Programs for inspecting heightenings, for example of beading or welds on circular profile sections, can be found in this group.
 - Start/End: Determination of a heightening and calculation of the X coordinates of the start and end point.
 - Maximum: Determination of a heightening and calculation of the coordinates of the point with maximum height.
 - Width/Height: Determination of a heightening and calculation of its width and height.
 - Area: Determination of a heightening and calculation of its area
- Circle Groove: Programs for inspecting deepening, for example of a groove or a gap on circular profile sections, can be found in this group.
 - Start/End: Determination of a deepening and calculation of the X coordinates of the start and end point.
 - Minimum: Determination of a deepening and calculation of the coordinates of the point with maximum depth.
 - Width/Depth: Determination of a deepening and calculation of its width and depth.
 - Area: Determination of a deepening and calculation of its area.
- Tools: Useful utilities can be found in this group.
 - Display Image Data: Visualization of the image data recorded by the sensor matrix.
 - Display Profiles: Display of the profile data.
 - Save Profiles: Save profile sequences for later offline analysis.
 - Calibrate Position: Adjusting the mounting position of the measurement system.

2. Installation and Preparation for Measurement Operation

2.1 Installation Requirements

The following minimum system specification is necessary for the operation of Configuration Tools:

- Windows 8 or 8.1 (64 bit), Windows 10 (64 bit), Windows 11 (64 bit)
- 1-GHz processor (64 bit)
- 1 GB RAM
- Screen resolution: 1024x768

To be able to use Configuration Tools the following steps must be followed:

- 1. Install the Ethernet interface hardware respectively, if not already installed.
- 2. Install Configuration Tools (see Chapter 2.2).
- 3. Connect the scanCONTROL measurement system to the PC via Ethernet.

[CD]:\Documentation	Contains manuals, installation instructions and Quick Reference
[CD]:\Program\scanCONTROL Configuration Tools 6.8\x64	Contains scanCONTROL Configuration Tools 6.8
[CD]:\Examples	Contains examples of profile sequences
[CD]:\License	Contains license information for scanCONTROL Configuration Tools
[CD]:\Support\Ethernet	Contains a software tool for configuration of the IP addresses of scanCONTROL devices with an Ethernet interface
[CD]:\Support\FImageFilter\x64	Contains filter files for integrating DirectX
[CD]:\Support\VCRedist2008	Contains the "Microsoft Visual C++ 2008" Redistributable Package
[CD]:\Support\VCRedist2017	Contains the "Microsoft Visual C++ 2017" Redistributable Package

Fig. 2.1: Contents of the Software CD

2.2 Installation of Configuration Tools

When you insert the Software CD an installation window appears which offers you a number of options. Alternatively you can start the window with the [CD]:\setup.exe file.

- Click on the "Install" button to start installing the software.

Now the installation wizard installs the software and necessary components.

Note: You need administrator rights in order to install Configuration Tools.

Note: Activate the "Configure windows firewall" option in order to enable the data transfer between scanCONTROL and the PC in case of an active windows firewall.

Note: If a third-party firewall is installed on your operating system, you need to include Configuration Tools in the firewall exception list to enable communication between the measuring system and the software.

2.3 Connecting scanCONTROL to the PC

In order to connect scanCONTROL via Ethernet to the PC, proceed as follows:

- Finish the installation of scanCONTROL Configuration Tools completely. This procedure is described in Chap. 2.2.
- Connect scanCONTROL via the Ethernet interface to the PC and switch on the power supply.
- Please wait until the device is recognized by the PC. This may take a few seconds.

The system is now ready to operate the scanCONTROL measurement system with scanCONTROL Configuration Tools.

Note: scanCONTROL must be connected directly with the PC. Do not use hubs and only suitable switches.

Note: In case of using a network adapter which supports the "VLAN" option, this option must be inactive in order to use the scanCONTROL measurement system.

Note: The PC and the measurement system must be located in the same subnet in order to operate the scanCONTROL measurement system with Configuration Tools. Use the "Ethernet Configurator" dialog box (see Chapter [3.21](#)) in order to adjust the network settings of the measurement system, if necessary.

3. Working with scanCONTROL Configuration Tools

3.1 Starting scanCONTROL Configuration Tools

Once the installation of the software and the driver is completed you can start the software. To do this, use the program shortcut on your desktop or select "scanCONTROL Configuration Tools" in the Startup menu.

Once you have started the program, the main window for starting the measuring programs will be displayed.

Note: If the "Advanced" option is selected for the "Connect to sensor" parameter (see Chapter 3.20), the dialog for selecting the sensor appears after the software has been started (see Chapter 3.5.2).

3.2 Elements of the Main View

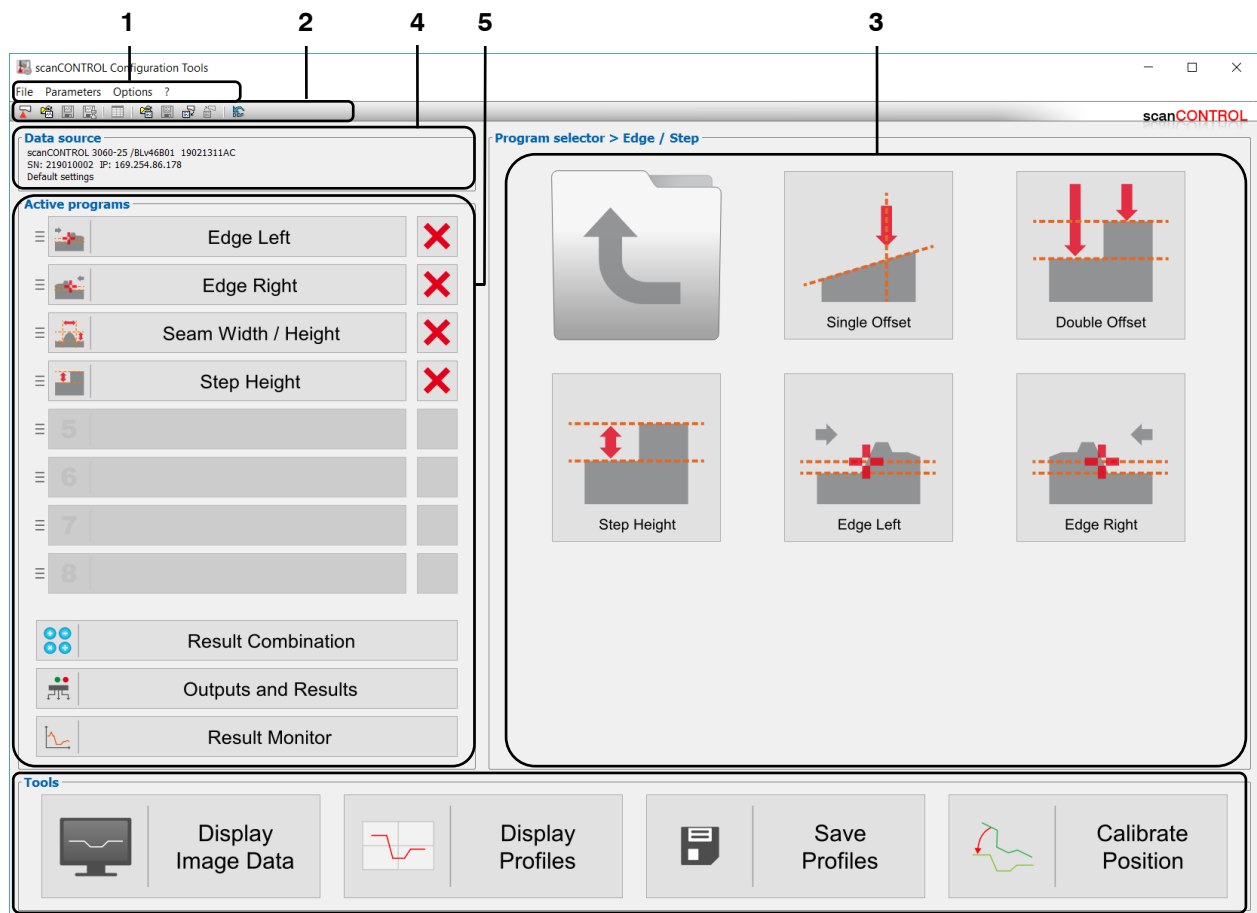


Fig. 3.1: Main View

1 Menu bar: Invoke various settings (mainly used in the individual measuring programs) and start the "Export Profiles" program.

2 Toolbar: Use the toolbar for loading and saving parameters and for restoring them to default settings.

3 Selection panel: Select the desired measuring programs. The measuring programs are split into several groups. The selected programs are shown in the "Active programs" input field.

4 Data source: The type, IP address and serial number of the currently connected measurement system and the recently used parameters are displayed in this area.

5 Active programs: Open the views for configuring the active measuring programs, for combining measured values, for configuring the output ports of scanCONTROL and for the statistical evaluation of the measurement. Use the dragging area on the left to change the order of measuring programs. Additionally, you may change the order of the programs and you may remove active programs.

6 Tools: Open several useful utilities.

Note: The "Data source" area (see Fig. 3.1, section 4) is only visible if the "Advanced" option is selected for the "Connect to sensor" parameter (see Chapter 3.20).

Note:

- Never disconnect the connection between scanCONTROL and the PC while using the software.
- Never disconnect the power supply of scanCONTROL while the software is running.

This may cause the software to shut down unintentionally.

3.3 Configuring scanCONTROL Step by Step

The basic steps for configuring scanCONTROL in order to solve a measuring task are described below:

- Use the "Program selector" input field (see Fig. 3.1) in order to select up to 16 measuring programs. The selected programs are shown in the "Active programs" input field.
- Configure the individual measuring programs. To do this, press the according buttons in the "Active programs" input field (see Fig. 3.1) or use the navigation menu (see Chapter 3.19). The view of the selected measuring program will be shown (see Chapter 4).
- Combine measured values, if necessary. You will access the "Result Combination" view (see Chapter 5) by pressing the "Result Combination" button in the "Active programs" input field (see Fig. 3.1) or by using the navigation menu (see Chapter 3.19).
- Configure the filters for measured values and the output ports of scanCONTROL. You will access the "Outputs and Results" view (see Chapter 6) by pressing the "Outputs and Results" button in the "Active programs" input field (see Fig. 3.1) or by using the navigation menu (see Chapter 3.19).
- After completing the configuration of scanCONTROL, save the parameters of scanCONTROL to file (see Chapter 3.14.1). You will be able to load the stored file again later on.
- Store the parameters permanently on scanCONTROL (see Chapter 3.14.4). scanCONTROL always starts with the configuration stored last.
- Exit Configuration Tools and disconnect scanCONTROL from the PC. scanCONTROL continues to operate as an independent unit and performs the measurements using your defined settings.

3.4 Structure of the Measuring Programs

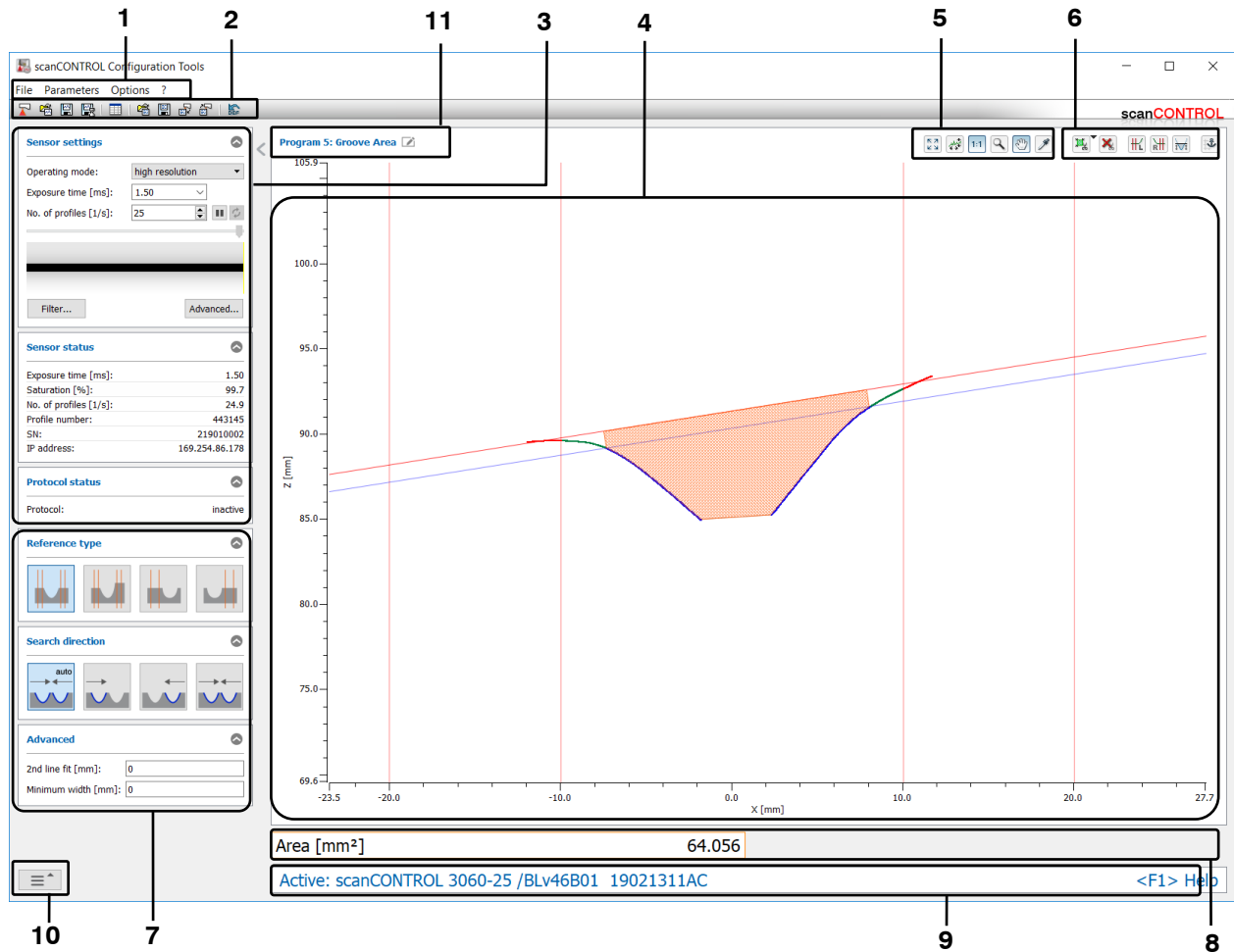


Fig. 3.2: Structure of a measuring program

The illustration shows the typical structure of a measuring program and the common input and display fields of the measuring programs. Each field is described in detail later in this user manual.

1 Menu bar: Using the menu bar, you can select the data source, return to the Main View, close Configuration Tools, save and load parameters, reset selected parameters to default settings, access the help and make basic settings (see Chapter 3.15).

2 "General" toolbar: Using this toolbar, you can select the data source, save profile sequences, save and load parameters and reset selected parameters to default settings (see Chapter 3.16).

3 Scanner settings: You change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10).

4 2D-display: This display shows the last measured profile. Either a scanCONTROL measurement system which transfers data to the PC or a file in which profiles of a scanCONTROL measurement system have been recorded previously is used as data source for the profile. Using the toolbars (see below), you can adjust search areas in the 2D-display directly with the mouse and scale the display.

5 "Display" toolbar: Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).

6 "Measurement" toolbar: Using this toolbar, you adjust the various search areas and limits for the measurement and activate or deactivate the dynamic tracking of the search areas (see Chapter 3.18).

7 Measurement setting: You select various measurement settings in this area (see Chapter 3.13.1).

8 Results display: The results of the current valid measurement are displayed.

9 Status line: Status and error messages are displayed on the status line. Refer to Chapter 9.1 "Status and error messages" for more detailed information.

10 Navigation menu: Press this button in order to display the navigation menu (see Chapter 3.19).

11 Name of the measuring program: You may rename the measuring program here.

Note: The individual display elements vary depending on the measuring program.

Note: The settings in a measuring program are saved and used again when restarting the measuring program. You reset the parameters back to the factory settings by selecting the function "Parameters → Reset" from the menu bar or by pressing the corresponding button (see Fig. 3.3) in the "General" toolbar.



Fig. 3.3: "Reset" button

Note: In order to save the parameters of the active measuring programs select the "Parameters → Save parameters to file" menu item or press the corresponding button in the "General" toolbar.

Note: The settings for scanCONTROL in the "Scanner settings" area of the current measuring program used are applied in all other measuring programs and views.

3.5 Selecting the Data Source

There are two ways for selecting the data source (see Chapter 3.20):

- Standard mode: When starting a measuring program, the software automatically connects to a connected scanCONTROL measurement system and parameterizes it with current measuring program settings (see Chapter 3.5.1).
- Advanced mode: After starting the software, Configuration Tools offers a list of available scanCONTROL measurement systems and their parameterization options. After selecting a measurement system, the software connects to the selected measurement system and provides various options for parameterization (see Chapter 3.5.2).

3.5.1 Selecting the Data Source in standard mode

When starting a measuring program in standard mode (see Chapter 3.20), the measuring program uses a connected scanCONTROL measurement system as data source. The software connects to the measurement system and parameterizes it with current measuring program settings. In order to load and display profiles from a previously saved file, either select the menu item "File → Load profiles" or press the corresponding button (see Fig. 3.4) in the "General" toolbar.



Fig. 3.4: "Load profiles" button

A standard Windows dialog is displayed for selection of the path and file name. The profile sequence is loaded after confirmation of the dialog. The measurement system now uses the loaded profile sequence as data source. The "Scanner settings" input field will be replaced by the "File settings" input field. You can control the playback of the loaded profile sequence in the File Settings input field (see Chapter 3.10).

Note: Use the "Recent profiles" menu item to load and display previously saved or loaded profile sequences.

In order to use the connected scanCONTROL measurement system as data source again, either select the menu item "File → scanCONTROL" or press the corresponding button (see Fig. 3.5) in the "General" toolbar.



Fig. 3.5: "scanCONTROL" button

If several sensors are connected, a dialog for selecting a measurement system appears (see Fig. 3.6). Select a measurement system and confirm the dialog with the "OK" button to establish a connection to the selected measurement system.

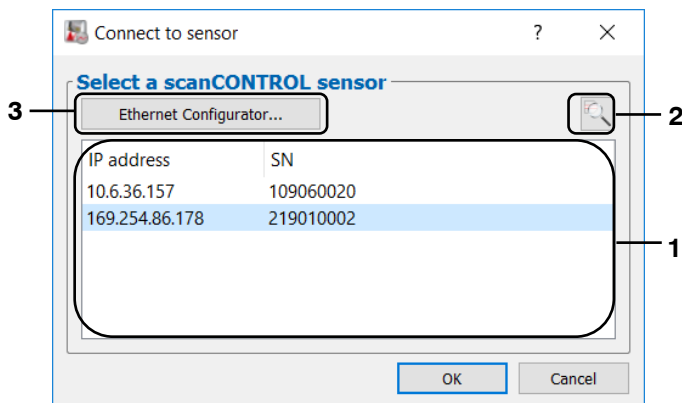


Fig. 3.6: "Connect to sensor" dialog box (standard mode)

Parameters in the "Connect to sensor" (standard mode) dialog box:

- 1 Scanner list:** This list contains all scanCONTROL measurement systems connected to the PC.
- 2 Scan for sensors:** Press this button in order to identify all scanCONTROL measurement systems which are connected to the PC.
- 3 Ethernet Configurator...:** Activates a dialog where you can modify the network settings of scanCONTROL measurement systems (see Chapter 3.21).

The measuring program now uses the connected scanCONTROL measurement system as data source again. The "File settings" input field will be replaced by the "Scanner settings" input field. You can make settings for the measurement system in the "Scanner settings" input field (see Chapter 3.7).

3.5.2 Selecting the Data Source in advanced mode

After starting the software in extended mode (see Chapter 3.20), a dialog for selecting a measurement system appears (see Fig. 3.7). Select a measurement system, enter the IP address manually if necessary and confirm the dialog with the "OK" button to establish a connection with the selected measurement system.

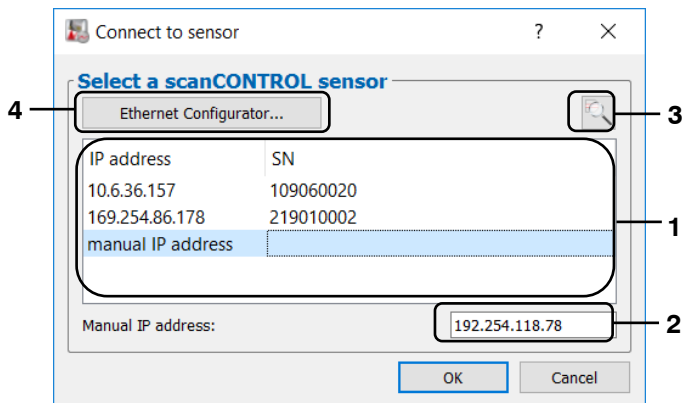


Fig. 3.7: "Connect to sensor" dialog box (advanced mode)

Parameters in the "Connect to sensor" (advanced mode) dialog box:

- 1 Scanner list:** This list contains all scanCONTROL measurement systems connected to the PC. In this list you also may activate the manual input of the IP address.
- 2 Manual IP address:** If the manual input of the IP address is activated, you may enter the IP address of the measurement system here.
- 3 Scan for sensors:** Press this button in order to identify all scanCONTROL measurement systems which are connected to the PC.
- 4 Ethernet Configurator...:** Activates a dialog where you can modify the network settings of scanCONTROL measurement systems (see Chapter 3.21).

After you have selected a scanCONTROL measurement system, a dialog for the parameterization of the connected measurement system appears (see Fig. 3.8).

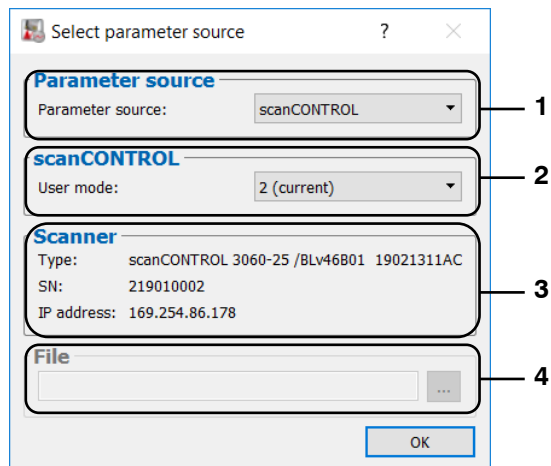


Fig. 3.8: "Select parameter source" dialog box

Parameters in the "Select parameter source" dialog box:

- 1 Parameter source:** Select the parameter source:
 - **scanCONTROL:** The parameter settings saved on the measuring system are read back into the software (see Chapter 3.14.5). The parameters of the measurement system are not changed.
 - **File:** The measuring system is parameterized with parameters from a file (see Chapter 3.14.2).
 - **Current settings:** The measurement system is parameterized with the current settings of the software.
 - **Default settings:** The measurement system is parameterized with the default settings of the software.

2 User mode: If a scanCONTROL measurement system is selected as the parameter source, you can select the parameter set (user mode) or the current sensor settings to be loaded here (see Chapter 3.14.5).

3 Scanner: The type, IP address and serial number of the connected measurement system are displayed.

4 File: If a parameter file is selected as the parameter source, you can select the parameter file here.

When switching to the main view, communication with the scanCONTROL measuring system is maintained. The main view shows the type, the IP address, the serial number and the recently used parameters.

To load and display previously saved profiles from a file, proceed as described in Chapter 3.5.1.

3.6 Saving Profile Sequences

There are two ways to store profile sequences for subsequent offline analysis:

- Storing a profile sequence continuously: After triggering the save operation, the profiles which are transferred from the measurement system to the PC will be stored (see Chapter 3.6.1).
- Storing the ring buffer: Profiles which have been collected in the ring buffer continuously are stored when triggering the save operation (see Chapter 3.6.2).

Note: In order to save profile sequences at high speed or to reduce the size of the target file, select the "Save Profiles" measuring program (see Chapter 4.11.3).

Configuration Tools provides the possibility to trim an existing profile sequence and to save the resulting segment as new profile sequence. Proceed as follows:

- Load the original profile sequence (see Chapter 3.5).
- Now mark the range to be saved as new profile sequence (see Chapter 3.10, Section 2).
- Press the "Save profiles" button (Fig. 3.9) in order to save the marked segment as new profile sequence.

3.6.1 Saving Profile Sequences continuously

In order to save profile sequences for later offline analysis (see Chapter 3.5), either select the menu item "File → Save profiles" or press the corresponding button (see Fig. 3.9) in the "General" toolbar.



Fig. 3.9: "Save profiles" button

A standard Windows dialog is displayed for selection of the path and file name for saving the profile sequence. After confirmation, the profiles transferred from scanCONTROL to the PC are stored in the selected file continuously. This process is displayed in a status dialog (see Fig. 3.10).

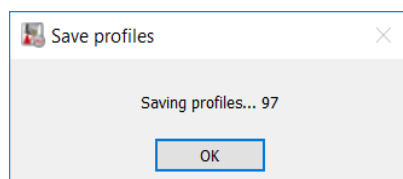


Fig. 3.10: "Save profiles" status dialog box

Press the "OK" button to finish the saving process.

Note: When saving an offline profile sequence, the subsequently changed filter and inverting settings (see Chapter 3.10) are not taken into account.

3.6.2 Saving Ring Buffer

The ring buffer is continuously filled with profile data from the measurement system.

In order to save a profile sequence from the ring buffer either select the menu item "File → Save ring buffer" or press the corresponding button (see Fig. 3.11) in the "General" toolbar.



Fig. 3.11: "Save ring buffer" button

A standard Windows dialog is displayed for selection of the path and file name for saving the profile sequence. The ring buffer is not filled during the file selection process. Once the selection has been confirmed, the profiles from the ring buffer are saved in the selected file, and the filling of the ring buffer is continued.

Note: You may parameterize the size of the ring buffer in the "Settings" dialog (see Chapter [3.20](#)).

3.7 Scanner Settings

The parameters in this input field are used to configure the scanCONTROL measurement system for your measuring task.

Note: The parameters "Exposure time"/"No. of profiles" are dependent on each other. E.g. setting the "No. of profiles" parameter to 50 profiles per second limits the "Exposure time" parameter to a maximum value of 20 ms.

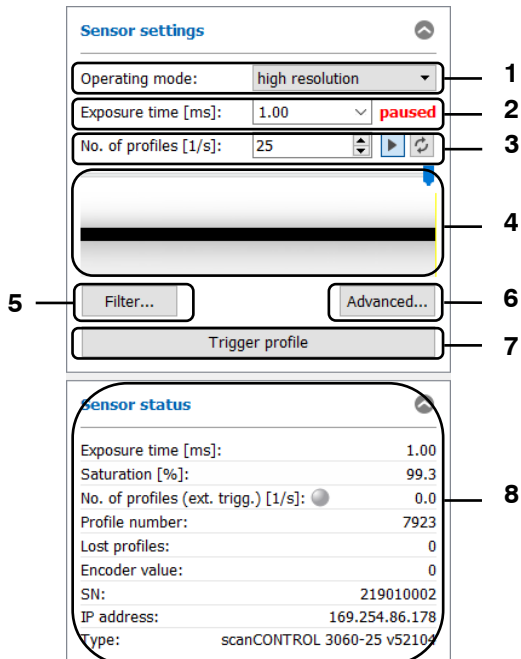




Fig. 3.12: "Scanner settings" input field

Parameters in the "Scanner settings" input field:

- 1 Operating mode:** With this parameter you select the operating mode of scanCONTROL.
- **High resolution:** scanCONTROL is operated with the maximum resolution in Z direction.
 - **High speed:** scanCONTROL is operated at a frequency of up to 10 kHz (scanCONTROL 30XX). The resolution in Z direction is halved. The resolution in the X direction remains unchanged.
 - **High dynamic range (HDR):** scanCONTROL is operated in the High Dynamic Range (HDR) mode. The resulting profile is composed of two profiles with different exposure times.
- 2 Exposure time [ms]:** With this parameter you select the exposure time for scanCONTROL. In the bottom area of the dialog the saturation is displayed. This is influenced by the exposure time and should be between 70 % and 90 % for a measurement.
- **Minimum:** 0.01 ms
 - **Maximum:** 40.0 ms
- 3 No. of profiles [1/s]:** This parameter regulates the number of measurements per second. This value has priority over the entry in the "Exposure time" box.
- **Minimum:** 25
 - **Maximum:** depends on the type of sensor:
 - scanCONTROL 2600/2610/2900/2910: 300
 - scanCONTROL 2700/2710: 100
 - scanCONTROL 2650/2660/2750/2760/2657: 4000
 - scanCONTROL 25X0/2950/2960: 2000
 - scanCONTROL 30XX: 10000

Note: The "No. of profiles" parameter must not exceed the maximum profile frequency of the sensor, which results from various factors (see Chapter 3.9 "Advanced" tab sheet section 5).


-  **Start/Stop data transfer from scanner:** Starts/stops the data transfer from the scanner. When the data transfer is stopped, a correspondent status message is displayed above the button (see Fig. 3.12, section 1)
-  **Refresh profile data:** Use this button in order to transfer a current profile from the scanner in case of a stopped data transfer.

4 Ring buffer: The profile sequence from the ring buffer is displayed in the window (see Chapter 3.6.2). If the data transmission is stopped (see above), you can directly access the individual profiles by dragging the slider or the marking line in the preview.

5 Filter...: With this button you access the "Filter settings" dialog for configuring the profile filter (see Chapter 3.8).

6 Advanced...: With this button you access the "Advanced scanner settings" dialog (see Chapter 3.9).

7 Trigger profile: This button is only available when the scanCONTROL measurement system is operated in trigger mode (see Chapter 3.9, parameter "Trigger mode").

 Press this button to transmit a single profile from the scanner.

8 Sensor status: In the bottom area of the "Scanner settings" input field status information of the scanCONTROL measurement system are displayed. You may configure the display in the basic settings (see Chapter 3.20).

- **Exposure time [ms]:** The currently used exposure time.
- **Saturation [%]:** The saturation of the current signal in the region of interest marked green in the 2D-display (see Chapter 3.13.2). This can be precisely adjusted by changing the parameter "Exposure time". A saturation value between 70 % and 90 % is recommended.
- **No. of profiles [1/s]:** This display shows the effective scan rate being used for evaluation of the scanner data. The scan rate may deviate from the "No. of profiles [1/s]" parameter if the computer does not have sufficient processing power.
- **Profile number:** The current profile number.
- **Lost profiles:** The number of lost profiles since resetting the counter (connecting to the measurement system, changing the "Trigger mode" parameter, see Chapter 3.9, "Interface" tab, or using the "Reset lost profiles" button in the "Settings" dialog, see Chapter 3.20).
- **Encoder value/Digital inputs:** The current encoder value (see Chapter 3.9, "Interface" tab, Section 6) or the assignment of the digital inputs (see Chapter 3.9, "Interface" tab, Section 4).
- **SN:** The serial number of the scanCONTROL measurement system.
- **IP address:** The IP address of the scanCONTROL measurement system.
- **Type:** The currently used type of measurement system and the associated firmware version are displayed.

Note: The "Operating mode" parameter is only available when using a scanCONTROL 30X0 measurement system.

Note: The "Scanner settings" input field is only available when using a scanCONTROL measurement system (see Chapter 3.5).

Note: For further information on the configuration of the measurement system, please refer to the instruction manual of the measurement system used and to the documents "Quick Reference scanCONTROL" and "Manual scanCONTROL (Part B)" (see Chapter 3.15, Section 4 "Documentation").

3.8 Profile Filter Settings

In combination with the scanCONTROL measurement system Configuration Tools offers you the possibility of equidistantly resampling the profile data in the X direction and of filtering the profile data. If you want to use the filter functions, it is recommended to activate the equidistantly resampling.

- Use the "Filter..." button in the "Scanner settings" box (see Chapter 3.7) to open the "Filter settings" dialog box.

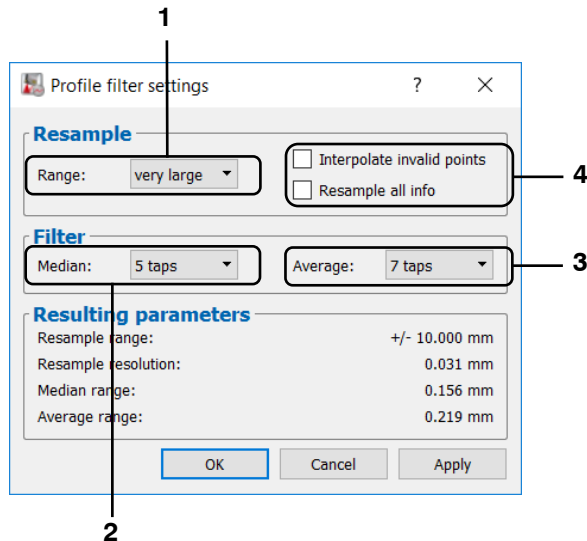


Fig. 3.13: "Profile filter settings" dialog box

Parameters in the "Profile filter settings" dialog box:

1 Range: The range which is equidistantly resampled.

Setting	Resampled range						
	XXXX-10	XXXX-25	XXXX-50	XXXX-100	XXXX-200	XXXX-430	XXXX-600
none	deactivated	deactivated	deactivated	deactivated	deactivated	deactivated	deactivated
tiny	±0.4 mm	±0.8 mm	±1.6 mm	±4.0 mm	±5.6 mm	±8.0 mm	±12.0 mm
very small	±0.5 mm	±1.0 mm	±2.0 mm	±5.0 mm	±7.0 mm	±10.0 mm	±15.0 mm
small	±1.0 mm	±2.0 mm	±4.0 mm	±10.0 mm	±14.0 mm	±20.0 mm	±30.0 mm
medium	±2.0 mm	±4.0 mm	±8.0 mm	±20.0 mm	±28.0 mm	±40.0 mm	±60.0 mm
large	±4.0 mm	±8.0 mm	±16.0 mm	±40.0 mm	±56.0 mm	±80.0 mm	±120.0 mm
very large	±5.0 mm	±10.0 mm	±20.0 mm	±50.0 mm	±70.0 mm	±100.0 mm	±150.0 mm
maximum	±10.0 mm	±20.0 mm	±40.0 mm	±100.0 mm	±140.0 mm	±200.0 mm	±300.0 mm

2 Median: With this parameter you activate a median filter.

- **none:** The median filter is not used.
- **3 taps:** You use a median filter with a filter size of three.
- **5 taps:** You use a median filter with a filter size of five.
- **7 taps:** You use a median filter with a filter size of seven.

3 Average: With this parameter you activate an average filter.

- **none:** The average filter is not used.
- **3 taps:** You use an average filter with a filter size of three.
- **5 taps:** You use an average filter with a filter size of five.
- **7 taps:** You use an average filter with a filter size of seven.

4 Interpolate invalid points: If equidistantly resampling is active, this specifies whether invalid points will be replaced by neighboring valid points using linear interpolation. Gaps will be closed if this parameter is active. In order to leave gaps open you must not activate this parameter.

Resample all info: If equidistantly resampling is active, this parameter specifies which data will be recalculated according to the equidistantly resampling. Deactivate this parameter to recalculate the X and Z coordinates only. Activate this parameter to recalculate all data (X / Z coordinates, width, intensity, threshold and moment 0th order). This parameter has no influence on the 2D-display.

Note: Activate the "Resample all info" parameter to store a profile sequence (see Chapter 3.6) and analyze it later with the "scanCONTROL 3D-View" software.

Confirm your settings with the "OK" button.

Note: When using a file as data source (see Chapter 3.5), the filter functions are only available if the filter and resampling functions have been disabled during saving the profile sequence.

3.9 Advanced Scanner Settings

The "Advanced scanner settings" dialog box offers you extended settings for the scanCONTROL measurement system.

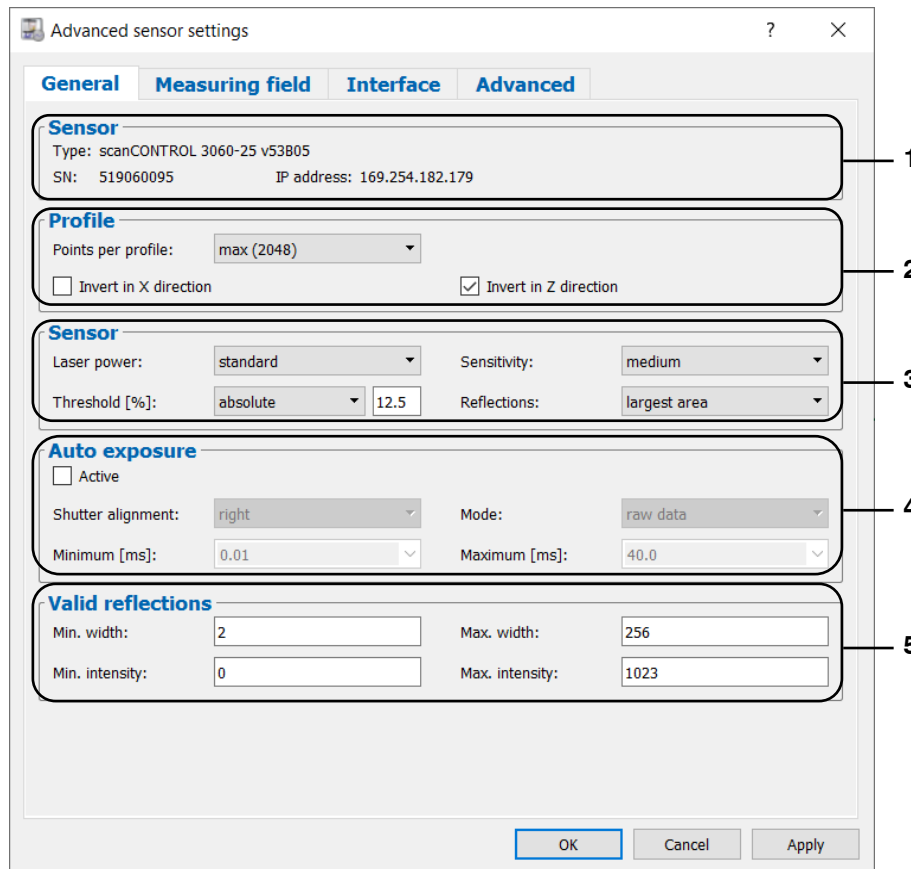


Fig. 3.14: "General" tab sheet in the "Advanced scanner settings" dialog box

Note: Only experienced users of the scanCONTROL measurement system should adjust any settings in this dialog box.

Parameters in the "General" tab sheet in the "Advanced scanner settings" dialog box:

- 1 - **Type:** The currently used type of measurement system and the associated firmware version are displayed.
- **SN:** The serial number of the currently used measurement system is displayed.
- **IP address:** The IP address of scanCONTROL is displayed.
- 2 - **Points per profile:** This parameter defines the number of points that make up a profile. Depending on the type of sensor you can choose between the following values:
 - **scanCONTROL 25X0:**
 - 160
 - 320
 - 640
 - **max (640):** The maximum number of points per profile, which is provided by the measurement system used.
 - **scanCONTROL 26X0/27X0:**
 - 80
 - 160
 - 320
 - 640
 - **max (640):** The maximum number of points per profile, which is provided by the measurement system used.

- **scanCONTROL 29X0:**
 - 160
 - 320
 - 640
 - 1280
 - **max (1280):** The maximum number of points per profile, which is provided by the measurement system used.
- **scanCONTROL 30X0:**
 - 256
 - 512
 - 1024
 - 2048
 - **max (2048):** The maximum number of points per profile, which is provided by the measurement system used.
- **scanCONTROL 30X2:**
 - 256
 - 512
 - 1024
 - **max (1024):** The maximum number of points per profile, which is provided by the measurement system used.

With this parameter you specify the resolution in the direction of the X axis. The number of points is also influenced by the "Measuring field" parameter!

- **Invert in X direction:** The signal is inverted on the Z axis.
 - **Invert in Z direction:** The signal is inverted parallel to the X axis (see Chapter 8.2.4 also). This function is enabled in the default settings.
- 3**
- **Laser power:** You can operate the laser of scanCONTROL at two different power levels or switch it off. Depending on the type of sensor the following options are available:
 - **scanCONTROL 25X0/26X0/29X0/30XX:**
 - **off:** Laser is switched off.
 - **reduced:** reduced power level.
 - **standard:** standard power level.
 - **reduced (pulsed):** pulsating at reduced power level. This option is used to synchronize two scanCONTROL measurement systems with alternately pulsed lasers.
 - **standard (pulsed):** pulsating at standard power level. This option is used to synchronize two scanCONTROL measurement systems with alternately pulsed lasers.
 - **scanCONTROL 27X0:**
 - **off:** Laser is switched off.
 - **reduced:** reduced power level.
 - **standard:** standard power level.
 - **Sensitivity:** Use this value to define the sensitivity of the sensor.
 - **minimum:** The selected sensitivity corresponds to the minimum value.
 - **low:** The selected sensitivity corresponds to the low value.
 - **medium:** The selected sensitivity corresponds to the medium value.
 - **high:** The selected sensitivity corresponds to the high value.
 - **maximum:** The selected sensitivity corresponds to the maximum value.
 - **Threshold [%]:** This value specifies the level of intensity at which scanCONTROL recognizes a reflection. In the bottom area of the "Scanner settings" input field the saturation is displayed (see Chapter 3.7). The saturation is influenced mainly by the threshold and should be between 70 % and 90 % for a measurement.
 - **absolute:** The chosen threshold (0 – 99.9) is used as absolute threshold.
 - **dynamic:** The chosen threshold (0 – 93.75 in 6.25 increments) is used as a percentage of the maximum intensity of a reflection.

- **Reflections:** This parameter is for specifying which reflection is recognized as a profile point and is only of importance for multiple reflections.
 - **first:** The reflection closest to the scanner.
 - **last:** The reflection furthest away from the scanner.
 - **largest area:** The reflection with the largest area. This function is enabled in the default settings.
 - **highest intensity:** The reflection with the highest intensity.
 - **only single:** The reflection is processed only if there is only a single reflection for this profile point.

- 4 - **Auto exposure:** Use these parameters to configure the automatic exposure time control.
 - **Active:** Select this input field to activate the automatic exposure time control of the scanCONTROL measurement system. This setting is recommended for scanning single-colored, alternating surfaces.
 - **Shutter alignment:** With this parameter you determine how the specified scan rate is maintained with active automatic exposure time control.
 - **center:** The intervals are in each case aligned to the center of the interval.
 - **right:** The intervals are in each case aligned to the end of the interval.
 - **left:** The intervals are in each case aligned to the start of the interval.
 - **none:** The intervals are not aligned.
 - **Mode:** Use this parameter to specify the algorithm for the automatic exposure time control
 - **raw data:** The automatic exposure time control is computed based on the raw data (Sensor matrix).
 - **profile:** The automatic exposure time control is computed based on the profile data.
 - **filtered profile:** The automatic exposure time control is computed based on the filtered profile data.
 - **Minimum [ms]:** The minimum exposure time used for the automatic exposure time control.
 - **Maximum [ms]:** The maximum exposure time used for the automatic exposure time control.

- 5 - **Min. width:** Minimum width of a reflection to be detected as a valid profile point.
- **Max. width:** Maximum width of a reflection to be detected as a valid profile point.
- **Min. intensity:** Minimum intensity of a reflection to be detected as a valid profile point.
- **Max. intensity:** Maximum intensity of a reflection to be detected as a valid profile point.

Note: The "Auto exposure - Minimum" and "Auto exposure - Maximum" parameters are only available when using a scanCONTROL 30XX measurement system. In HDR operating mode (see Chapter 3.7) the parameters apply to the longer exposure time.

Note: The available options for the "Auto exposure" parameter vary depending on the sensor type.

Note: The "Sensitivity" parameters is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 53). With the "Minimum" option the parameter can be deactivated.

Note: If a scanCONTROL 30X2 or scanCONTROL 30XX measurement system is used in the "High speed" or "High contrast (HDR)" operating mode (see Chapter 3.7), it is recommended to set the minimum width of a reflection ≥ 4 for better signal quality.

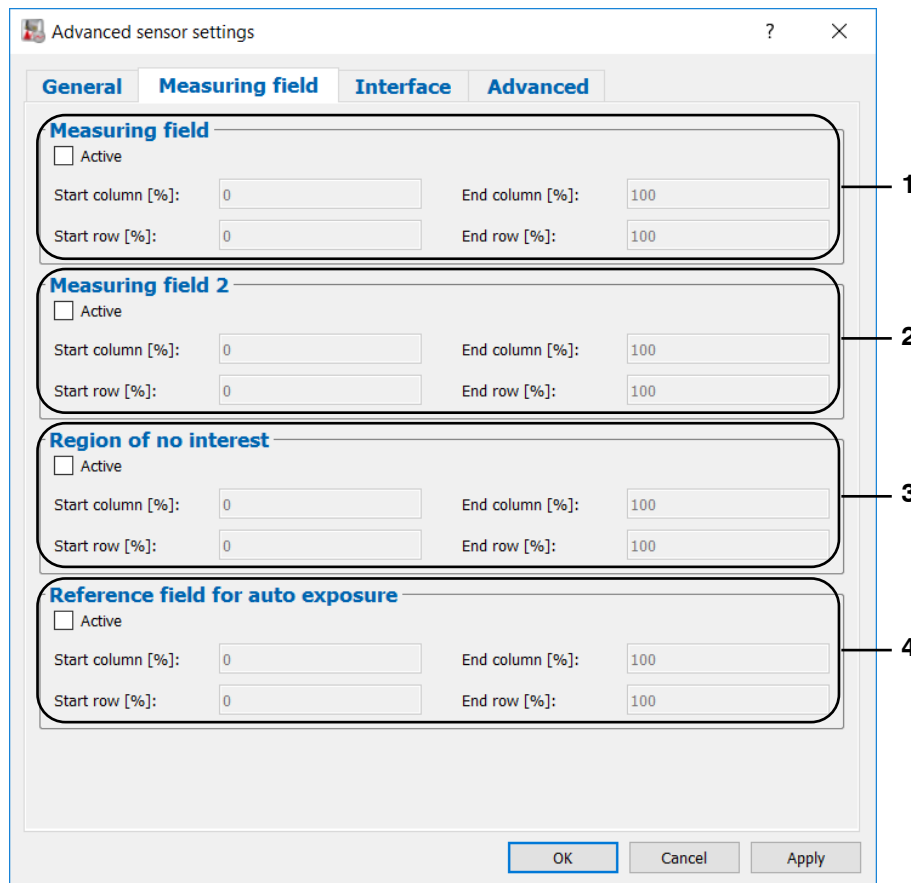


Fig. 3.15: "Measuring field" tab sheet in the "Advanced scanner settings" dialog box

Parameters in the "General" tab sheet in the "Advanced scanner settings" dialog box:

- 1 - **Measuring field:** Activate the measuring field of scanCONTROL. The measuring field is defined by the percentage of the start and end positions.
 - **Start column [%]:** The first column of the measuring field.
 - **End column [%]:** The last column of the measuring field.
 - **Start row [%]:** The first row of the measuring field.
 - **End row [%]:** The last row of the measuring field.
- 2 - **Measuring field 2:** Activate the second measuring field of scanCONTROL. The measuring field is defined by the percentage of the start and end positions.
 - **Start column [%]:** The first column of the second measuring field.
 - **End column [%]:** The last column of the second measuring field.
 - **Start row [%]:** The first row of the second measuring field.
 - **End row [%]:** The last row of the second measuring field.
- 3 - **Region of no interest:** Activate the measuring field of scanCONTROL, in which the profile points are not evaluated ("Region of no interest"). The measuring field is defined by the percentage of the start and end positions.
 - **Start column [%]:** The first column of the "Region of no interest".
 - **End column [%]:** The last column of the "Region of no interest".
 - **Start row [%]:** The first row of the "Region of no interest".
 - **End row [%]:** The last row of the "Region of no interest".
- 4 - **Reference field for auto exposure:** Activate the reference field of scanCONTROL, from which the profile points for the automatic exposure time are used. The measuring field is defined by the percentage of the start and end positions.
 - **Start column [%]:** The first column of the reference field.
 - **End column [%]:** The last column of the reference field.
 - **Start row [%]:** The first row of the reference field.
 - **End row [%]:** The last row of the reference field.

Profile points which are located in the "Measurement field" or in the "Measurement field 2" and not in the "Region of no interest" will be evaluated.

Note: The "Measuring field 2", "Region of no interest" and "Reference field for auto exposure" are only available when using a scanCONTROL 30XX.

Note: The "Start/End column" parameters must be a multiple of the following factors, depending on the type of sensor: scanCONTROL 26X0/27X0: 1.25 %; scanCONTROL 25X0/29X0: 2.5 %; scanCONTROL 30XX: 1.5625 %.

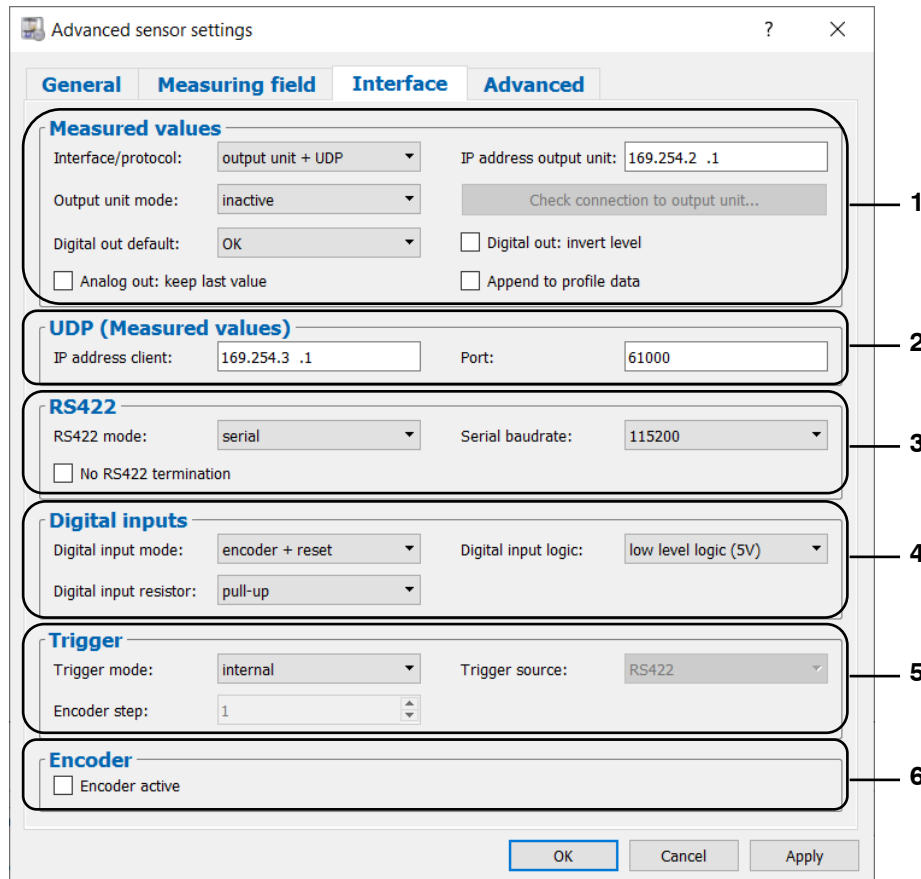


Fig. 3.16: "Interface" tab sheet in the "Advanced scanner settings" dialog box

Parameters in the "Interface" tab sheet in the "Advanced scanner settings" dialog box:

- 1 - **Interface/protocol:** With this parameter you select which interface is used for output of measured values (see Chapter 1.2):
 - **output unit + serial:** The measured values are supplied via 2D/3D Output Unit (digital and analog) and the RS422 interface (ASCII) (see Chapters 6.2, 6.3 and 6.4).
 - **output unit + UDP:** The measured values are supplied via 2D/3D Output Unit (digital and analog) and via Ethernet (UDP) (see Chapters 6.2, 6.3 and 6.5).
 - **modbus:** The Modbus protocol is used to output the measured values (see Chapter 6.6). The measured values are supplied via RS422 and Ethernet.
 - **gateway:** The measured values are supplied via 2D/3D Gateway (ProfiNET, Ethernet/IP and EtherCAT, see Chapter 6.7).
 - **output unit + UDP profiles:** The measured values are supplied via 2D/3D Output Unit (digital and analog, see Chapters 6.2 and 6.3) and profiles via Ethernet (UDP).
 - **modbus + UDP profiles:** The Modbus protocol is used to output the measured values (see Chapter 6.6). The measured values are supplied via RS422 and Ethernet. The profiles are supplied via Ethernet (UDP).
 - **gateway + UDP profiles:** The measured values are supplied via 2D/3D Gateway (ProfiNET, Ethernet/IP and EtherCAT, see Chapter 6.7). The profiles are supplied via Ethernet (UDP).

Note: The "output unit + UDP profiles", "modbus + UDP profiles" and "gateway + UDP profiles" options are only available when using a scanCONTROL 30XX (firmware version ≥ 53).

- **IP address output unit:** In case of using 2D/3D Output Unit with an Ethernet interface, you specify the IP address of 2D/3D Output Unit with this parameter.

Note: The "IP address output unit" parameter is used to establish a connection between the measurement system and Output Unit and is not used to set the IP address of the 2D/3D Output Unit.

Note: For detailed information on the configuration of the IP address of scanCONTROL Output please refer to the documentation of the Output Unit (Fieldbus coupler) used.

Note: When delivered, the 2D/3D Output Unit has the IP address 169.254.2.1.

- **Output unit mode:** With this parameter you activate or deactivate 2D/3D Output Unit for supplying digital and analog signals (see Chapter 6.2 and 6.3). Selecting the "default" setting you use the default setting of scanCONTROL Smart (active). This parameter is only effective using the scanCONTROL Smart product series.
- **Check connection to output unit...:** Use this button in order to check the connection of the scanCONTROL measuring system to the Output unit. This function is only available in the "Result Combination", "Outputs and Results" and "Result Monitor" views.
- **Digital out default:** Specifies the behavior of the criteria set to "None".
 - **OK:** The criterion is evaluated as OK.
 - **nOK:** The criterion is evaluated as nOK.
 - **keep last value:** The previous valid value is used.
- **Digital out: invert level:** In case of activating this parameter, the electrical signal, output at the digital outputs, is inverted (OK = low level, nOK = high level). In case of deactivating this parameter, the logical value corresponds to the electrical level (OK = high level, nOK = low level).
- **Analog out: keep last value:** Specifies the behavior of the analog outputs in case of an erroneous measurement. On activating this parameter the result of the previous valid measurement is output. When deactivating this parameter the signal is pulled to the lower limit of the voltage/current range.
- **Append to profile data:** Activate this setting in order to append the measurement values to the profile data (see Chapter 6.8).

Note: The "Append to profile data" parameter is not available using "output unit + UDP profiles", "modbus + UDP profiles" and "gateway + UDP profiles" options.

- 2 - **IP address client:** In case of transferring the measured values or profiles using UDP, you specify the IP address of the receiver (client) with this parameter.
- **Port:** Specifies the UDP port of the receiver (client).
- 3 - **RS422 mode:** Use this parameter to configure the function of the RS422 interface of scanCONTROL. Depending on the type of sensor you can choose between the following values:
 - **scanCONTROL 25X0/26X0/29X0/30XX**
 - **serial:** The RS422 interface is used as serial port. Measurement values are output and commands are received (see Chapter 6.4).
 - **ext. trigger input:** The RS422 interface is used as synchronization and trigger input (see below, parameter "Trigger mode").
 - **ext. trigger output:** The RS422 interface is used as synchronization and trigger output.
 - **CMM trigger:** Activate this setting in order to use the RS422 interface as programmable trigger output (see below, parameter "Enable CMM trigger").
 - **scanCONTROL 27X0**
 - **automatic:** scanCONTROL configures the function of the RS422 interface automatically.

- **serial:** The RS422 interface is used as serial port. Measurement values are output and commands are received (see Chapter 6.4).
 - **external trigger:** The RS422 interface is used to synchronize and trigger the scanCONTROL measurement system (see below, parameter "Trigger mode").
 - **CMM trigger:** Activate this setting in order to use the RS422 interface as programmable trigger output (see below, parameter "Enable CMM trigger").
 - **encoder/counter:** Activate this function in order to access the internal counter of scanCONTROL via the RS422 interface (see below, input field "Counter (Encoder)").
 - **pulsed laser:** The RS422 interface is used to synchronize two scanCONTROL measurement systems. The lasers are alternately pulsed.
- **Serial baudrate:** The baudrate at which the RS422 port is operated. This parameter is only available if the "RS422 mode" parameter is set to "serial".
 - 9600
 - 19200
 - 38400
 - 57600
 - 115200
 - **No RS422 termination:** Disables the termination resistor of the RS422 circuit. When deactivating this parameter, the default termination is used (serial: Termination active; ext. trigger input: Termination active; ext. trigger output: Termination inactive; CMM trigger: Termination inactive).
- 4
- **Digital input mode:** Use this parameter to configure the function of the digital inputs of scanCONTROL.
 - **scanCONTROL 25X0/26X0/29X0**
 - **encoder + reset:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 1 (index N) is used to reset the counter.
 - **encoder + trigger:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 1 is used as trigger input.
 - **trigger:** Input 1 is used as trigger input.
 - **user modes + trigger:** Input 1 is used as trigger input. Inputs 2 (bit 0) and 3 (bit 1) are used to load user modes.
 - **user modes:** Inputs 1 (bit 0), 2 (bit 1) and 3 (bit 2) are used to load user modes.
 - **timestamp:** The state of the digital inputs is included in the timestamp of the profiles and can be output in binary format as a measured value.
 - **encoder + container:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 1 serves as a trigger input for a profile container. This setting is intended for external programs and should not be used in conjunction with Configuration Tools.
 - **encoder (A) + container:** Input 2 (A) is used to access the internal counter of scanCONTROL. Input 1 serves as a trigger input for a profile container. This setting is intended for external programs and should not be used in conjunction with Configuration Tools.
 - **gated encoder:** On applying a logical "1" signal to the input 1 scanCONTROL is triggered using the encoder input. Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL.
 - **scanCONTROL 30XX**
 - **encoder + reset:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 4 (index N) is used to reset the counter.
 - **encoder + trigger:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 4 (index N) is used to reset the counter. Input 1 is used as trigger input.
 - **trigger:** Input 1 is used as trigger input. The state of the digital input 2, 3 and 4 is included in the timestamp of the profiles and can be output in binary format as a measured value.

- **user modes + trigger:** Input 1 is used as trigger input. Inputs 2 (bit 0), 3 (bit 1) and 4 (bit 2) are used to load user modes.
 - **user modes:** Inputs 1 (bit 0), 2 (bit 1), 3 (bit 2) and 4 (bit 3) are used to load user modes.
 - **timestamp:** The state of the digital inputs is included in the timestamp of the profiles and can be output in binary format as a measured value.
 - **encoder + container:** Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 1 serves as a trigger input for a profile container. Input 4 serves as a trigger for the output of the profile container. If the container is not completely filled with profile data, it is filled up with 0 values. This setting is intended for external programs and should not be used in conjunction with Configuration Tools.
 - **encoder (A) + container:** Input 2 (A) is used to access the internal counter of scanCONTROL. Input 1 serves as a trigger input for a profile container. Input 4 serves as a trigger for the output of the profile container. If the container is not completely filled with profile data, it is filled up with 0 values. This setting is intended for external programs and should not be used in conjunction with Configuration Tools.
 - **gated encoder:** On applying a logical "1" signal to the input 1 scanCONTROL is triggered using the encoder input. Inputs 2 (A) and 3 (B) are used to access the internal counter of scanCONTROL. Input 4 (index N) is used to reset the counter.
 - **trig. + user m. + timest.:** Input 1 is used as trigger input. Inputs 2 (bit 0) and 3 (bit 1) are used to load user modes. The state of the digital input 4 is included in the timestamp of the profiles and can be output in binary format as a measured value.
 - **user m. (3) + timest. (1):** Inputs 1 (bit 0), 2 (bit 1) and 3 (bit 2) are used to load user modes. The state of the digital input 4 is included in the timestamp of the profiles and can be output in binary format as a measured value.
 - **user m. (2) + timest. (2):** Inputs 1 (bit 0) and 2 (bit 1) are used to load user modes. The state of the digital input 3 and 4 is included in the timestamp of the profiles and can be output in binary format as a measured value.
- **Digital input logic:** Defines the logic of the digital inputs:
 - **low level logic (5V):** TTL
 - **high level logic (24V):** HTL
 - **Digital input resistor:** Define the resistor of the digital inputs:
 - **pull-up:** Pull-up resistor.
 - **pull-down:** Pull-down resistor.
- 5** - **Trigger mode:** This function enables you to control the scanCONTROL measurement system via the RS422 interface (scanCONTROL 25X0/26X0/27X0/29X0/30XX) and via the digital inputs (scanCONTROL 25X0/26X0/29X0/30XX) respectively.
- **internal:** scanCONTROL transfers continuously according to the setting "No. of profiles [1/s]"

Please use the following trigger settings only when you control scanCONTROL externally:

- **pos. edge:** scanCONTROL is triggered with positive edges whereas the exposure time corresponds to the parameter "Exposure time".
- **neg. edge:** scanCONTROL is triggered with negative edges whereas the exposure time corresponds to the parameter "Exposure time".
- **pos. pulse:** scanCONTROL is triggered with positive edges whereas the exposure time corresponds to the length of the positive trigger-pulse.
- **neg. pulse:** scanCONTROL is triggered with negative edges whereas the exposure corresponds to the length of the negative trigger-pulse.
- **pos. gate:** On applying a logical "1" signal to the trigger input scanCONTROL transfers continuously according to the setting "No. of profiles [1/s]". When applying a logical "0" signal to the trigger input no profiles are transferred.
- **neg. gate:** On applying a logical "0" signal to the trigger input scanCONTROL transfers continuously according to the setting "No. of profiles [1/s]". When applying a logical "1" signal to the trigger input no profiles are transferred.
- **encoder:** scanCONTROL is triggered using the internal counter (encoder). A measurement operation is triggered after N encoder steps (N is defined by the "Encoder step" parameter, see below).

Note: The maximum frequency available for triggering corresponds to the "No. of profiles [1/s]" parameter.

Note: More information about the trigger function of scanCONTROL can be found in the instruction manual of the measurement system used.

- **Trigger source:** Select the type of inputs used for synchronization and triggering:
 - **RS422**
 - **digital inputs**
 - **Encoder step:** Specifies the number of encoder steps being necessary to trigger a measurement operation. This parameter is only available if the "Trigger mode" parameter is set to "encoder".
- 6** - **Encoder active:** Activates the encoder input of scanCONTROL. It is possible to increment and decrement the counter.

Note: The "keep last value" option of the "Digital out default" parameter is not available using "modbus", "gateway", "modbus + UDP profiles" or "gateway + UDP profiles" options.

Note: The "Output unit mode", "IP address output unit" and "Analog out: keep last value" parameters are not available using "modbus", "gateway", "modbus + UDP profiles" or "gateway + UDP profiles" options.

Note: The "Output unit mode" and "IP address output unit" parameters are only effective using the scanCONTROL Smart product series. With using the scanCONTROL Compact or scanCONTROL High-Speed product series the parameters have no effect.

Note: The "No RS422 termination", "Digital input mode", "Digital input logic" and "Trigger source" parameters are only available when using a scanCONTROL 25X0, 26X0, 29X0 and 30XX measurement system.

Note: The "trig. + user m. + timest.", "user m. (3) + timest. (1)" and "user m. (2) + timest. (2)" options of the "Digital input mode" parameter are only available when using a scanCONTROL 30XX.

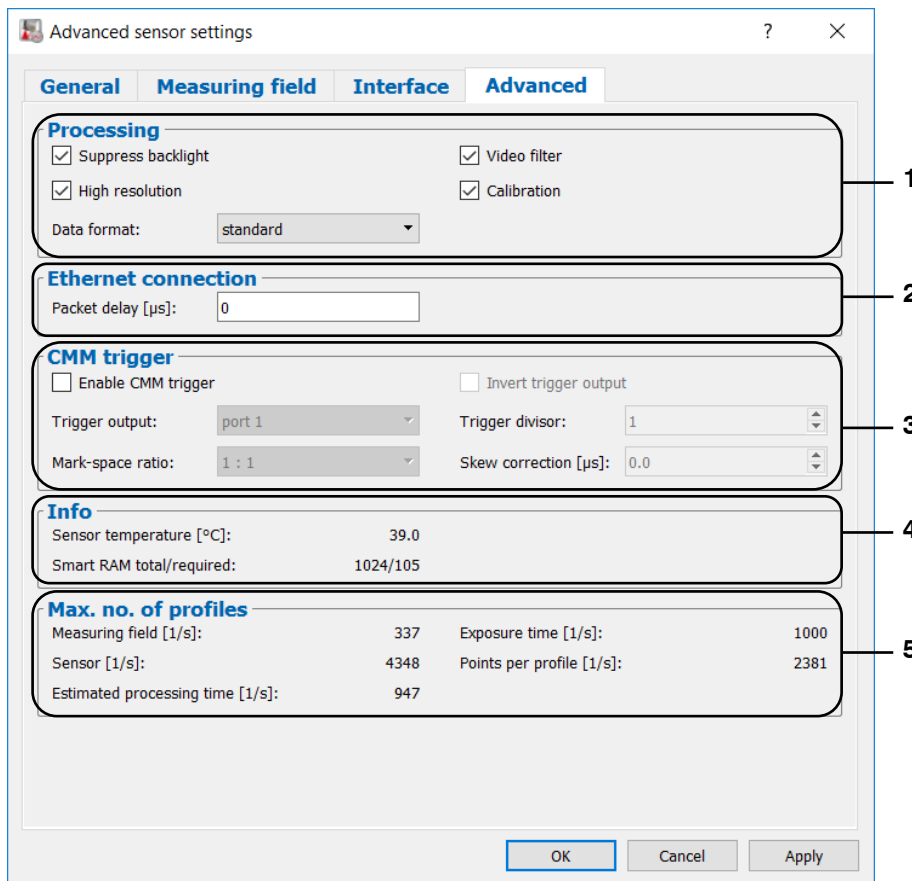


Fig. 3.17: "Advanced" tab sheet in the "Advanced scanner settings" dialog box

Parameters in the "Advanced" tab sheet in the "Advanced scanner settings" dialog box:

- 1
 - **Suppress backlight:** With this entry field you activate the automatic backlight compensation.
 - **Video filter:** Activate this parameter to improve the image quality.
 - **High resolution:** With this parameter you activate the subpixel resolution for the Z values.
 - **Calibration:** Use this parameter to activate the calibration.
 - **Data format:** Select the data transfer format. This setting determines the amount of data transferred and the required bandwidth of the Ethernet connection.
 - **Standard:** All profile information (X/Z coordinates, width, intensity, threshold and moment 0th order) is transmitted.
 - **Compressed:** The profile information is transmitted compressed. The moment 0th order is not transferred. This setting should be used when using high profile frequencies.

Note: When using the "compressed" format, a single boundary point of the profile may be lost under certain circumstances.

- 2
 - **Packet delay [µs]:** Specifies the delay time of transferred data packets via Ethernet. This parameter is of importance in case of synchronizing multiple sensors in one subnet.
- 3
 - **Enable CMM trigger:** Select this box to activate the programmable trigger output of scanCONTROL.
 - **Invert trigger output:** With this parameter you invert the trigger output.
 - **Trigger output:** The port at which the trigger signal is issued.
 - **Port 1**
 - **Port 2**

- **Trigger divisor:** This gives the division ratio between the trigger signals and the profiles. Select a value "n" to issue one trigger signal for every nth profile.
 - **Min:** 1
 - **Max:** 255
- **Mark-space ratio:** This gives the mark-space ratio for the decreasing edge.
 - **1:4** ▪ **2:1**
 - **1:3** ▪ **3:1**
 - **1:2** ▪ **4:1**
 - **1:1**
- **Skew correction [μ s]:** This parameter provides a time correction of the trigger signal in increments of 0.5 μ s.
 - **Minimum:** -256.0 μ s
 - **Maximum:** 255.5 μ s

Note: The "CMM trigger" settings are not available when using a scanCONTROL 25X0 measurement system.

- 4 - **Sensor temperature [$^{\circ}$ C]:** Shows the current temperature inside the sensor housing. This information is only available for scanCONTROL Smart.
- **Smart RAM total/required:** Two values are displayed. The first value indicates the size of the physical RAM of the connected measurement system. The second value indicates the size of the memory currently used.
- 5 - **Measuring field [1/s]:** The maximum profile frequency resulting from the setting of the "Measuring field" parameter.
- **Exposure time [1/s]:** The maximum profile frequency resulting from the setting of the "Exposure time" parameter.
- **Sensor[1/s]:** The maximum profile frequency resulting from the sensor hardware.
- **Points per profile [1/s]:** The maximum profile frequency resulting from the setting of the "Points per profile" parameter (scanCONTROL 30XX).
- **Estimated processing time [ms]:** The maximum profile frequency resulting from the estimation of the required time for a measurement operation. This information is only available for scanCONTROL Smart.

Confirm your settings with the "OK" button.

Note: For further information on the parameters for the measurement system described here, please refer to the documents "Quick Reference scanCONTROL" and "Manual scanCONTROL (Part B)" (see Chapter 3.15, Section 4 "Documentation").

Note: The "Advanced scanner settings" dialog box is only available when using a scanCONTROL measurement system (see Chapter 3.5).

3.10 File Settings

When using a saved profile sequence as data source the "File settings" input field is used to control the playback of the profile sequence.

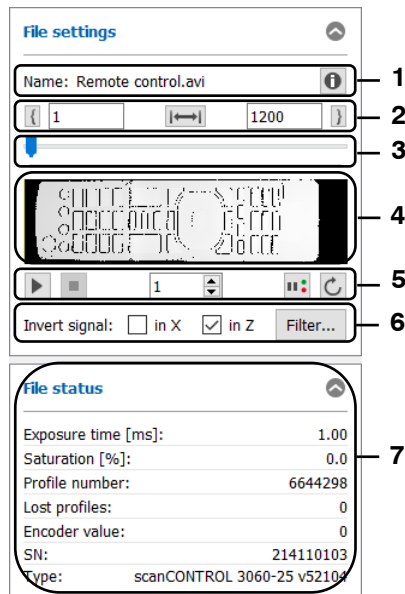


Fig. 3.18: "File settings" input field

Parameters and information in the "File settings" input field:

- 1 - **Name:** The name of the profile sequence.
- **Info:** You press this button to display the scanCONTROL settings selected when the profile sequence was saved (see Chapter 3.11).
- 2 - **Mark profile sequence:** You may mark a partial range of the loaded profile sequence using these input fields. When starting the playback only the marked range is played back.
 - : Use this button in order to use the profile currently displayed as lower limit of the marked range. Use the edit field in order to change the lower limit manually.
 - : Resets the marked range. When starting the playback the complete profile sequence is played back.
 - : Use this button in order to use the profile currently displayed as upper limit of the marked range. Use the edit field in order to change the upper limit manually.
- 3 - **Slider control:** Shows the progress of the playback of the profile sequence. When the playback is stopped you can activate individual profiles by dragging the slider. The display bar below represents the marked range for the playback of the profile sequence. The partial range may be modified using the parameters described in section 2.
- 4 - **Preview:** The window shows the loaded profile sequence. When the playback is stopped, you can directly access the individual profiles by dragging the slider or the marker line in the preview.
- 5 - **Play/Pause** : This starts/pauses the playback of the selected profile sequence.
- **Stop** : This stops the playback of the selected profile sequence.
- **Current profile** : While a profile sequence is being played you will see a run-through of the profile numbers in this box. If you stop the playback you can activate any individual profile directly by entering the profile number.
- **Pause if nOK** : If you activate this option, the playback of the profile sequence is paused if at least one digital output is evaluated as nOK (see Chapter 6.2) in the displayed profile.
- **Endless mode** : Use this button in order to activate the endless playback mode. After reaching the upper limit of the partial range for playback, the playback restarts automatically at the lower limit of the range.
- 6 - **Invert signal in X:** The signal is inverted on the Z axis.
- **Invert signal in Z:** The signal is inverted parallel to the X axis (see Chapter 8.2.4 also).

- **Filter:** With this button you access the "Filter settings" dialog for configuring the profile filter (see Chapter 3.8).
- 7
- **File status:** In the bottom area of the "File settings" input field the following information of the actual profile is shown. You may configure the display in the basic settings (see Chapter 3.20).
 - **Exposure time [ms]:** The used exposure time of scanCONTROL when the profile sequence was saved.
 - **Saturation [%]:** The saturation of the current signal in the region of interest marked green in the 2D-display (see Chapter 3.13.2). A saturation value between 70 % and 90 % is recommended.
 - **Profile number:** The current profile number.
 - **Lost profiles:** The number of lost profiles up to the current profile.
 - **Encoder value:** The encoder value of the current profile (see Chapter 3.9, "Interface" tab, Section 6).
 - **SN:** The serial number of the measurement system used for recording the profile sequence.
 - **Type:** The type of the measurement system used for recording the profile sequence.

Note: The "File settings" input field is only available with loading a profile sequence (see Chapter 3.5).

3.11 Displaying scanCONTROL Parameters in Offline Mode

When playing back saved profile sequences, you have the possibility of displaying the scanCONTROL settings used during saving.

- Press the info button in the "File settings" input field (see Chapter 3.10). You then access the "Scanner settings offline" dialog box.

In the dialog box you can choose between the following tabs:

Scanner: The standard settings of the measurement system are displayed. You will find a detailed description of the individual parameters in Chapter 3.7. Additionally the following information is shown:

- **Name:** The name of the profile sequence.
- **Path:** The path of the file.
- **Type:** The type of measurement system used for recording the profile sequence.
- **SN:** The serial number of the measurement system used for recording the profile sequence.
- **File format:** This indicates which information is contained in the saved profile sequence.
 - **x/z only:** The X and Z coordinates of the individual measurement points are saved.
 - **x/z + data:** A complete reflection is saved in the profile sequence. In a reflection the following information is contained for each measurement point: X/Z coordinates, width, intensity, threshold and moment of 0th order.
 - **x/z + [information]:** The X and Z coordinates of the individual measurement points, their additional information (e.g. "intensity") and the parameters used while saving the profile sequence have been saved.
 - **full set:** All four reflections, the time stamp and, where applicable, the measurement system parameters used during saving.
- **Changed:** The modification date of the profile sequence.
- **Buffered profiles:** The number of profiles contained in the loaded profile sequence.

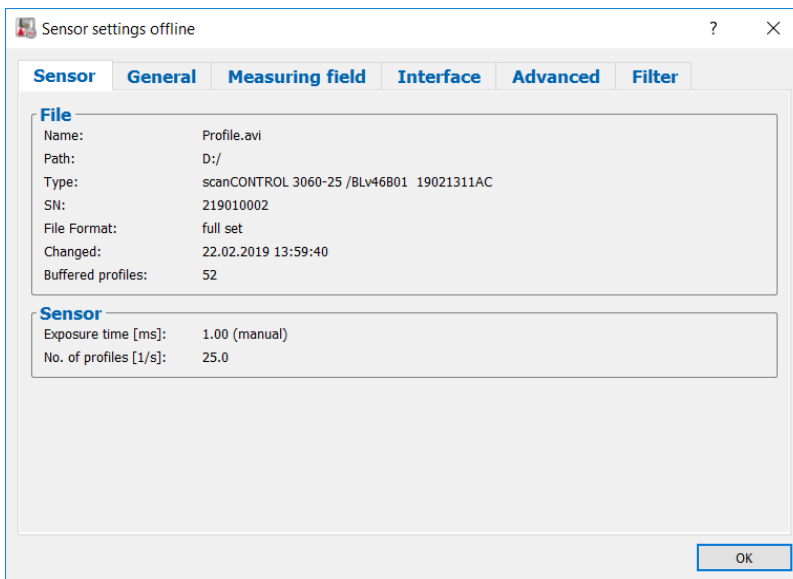


Fig. 3.19: "Scanner" tab sheet in the "Scanner settings offline" dialog

General: General settings of scanCONTROL are displayed. You will find a detailed description of the individual parameters in Chapter 3.9.

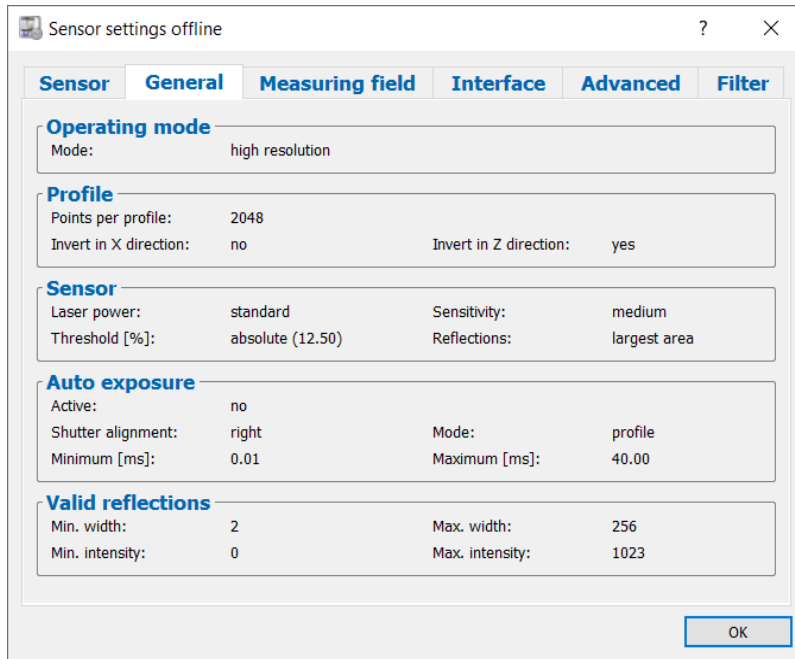


Fig. 3.20: "General" tab sheet in the "Scanner settings offline" dialog

Measuring field: Measuring field settings of scanCONTROL are displayed. You will find a detailed description of the individual parameters in Chapter 3.9.

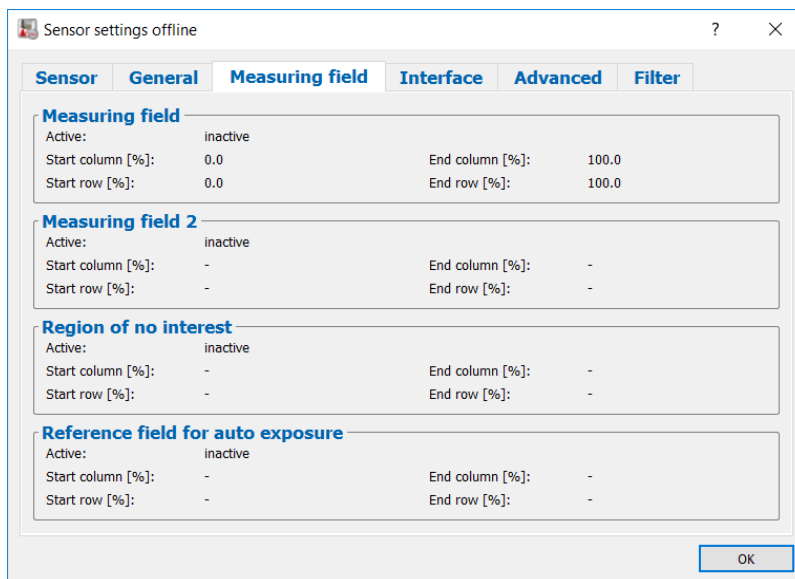


Fig. 3.21: "Measuring field" tab sheet in the "Scanner settings offline" dialog

Interface: The interface settings of scanCONTROL are displayed. You will find a detailed description of the individual parameters in Chapter 3.9.

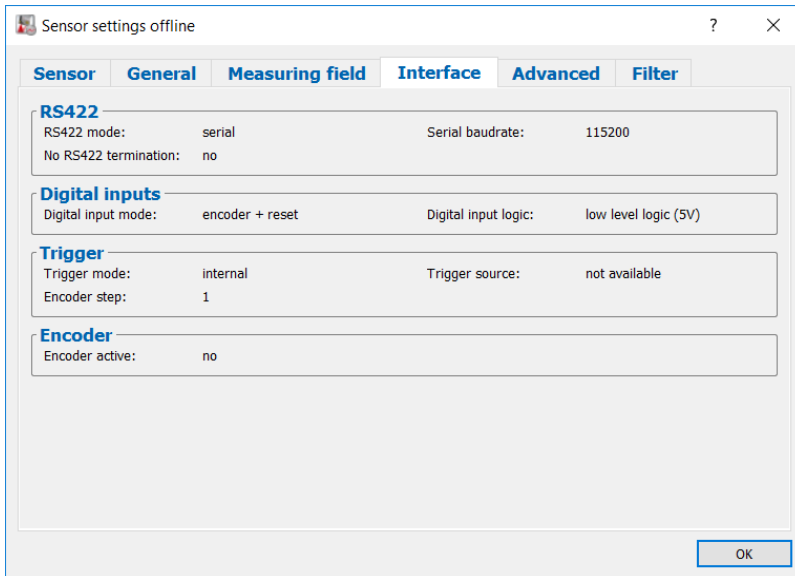


Fig. 3.22: "Interface" tab sheet in the "Scanner settings offline" dialog

Advanced: The extended settings of scanCONTROL are displayed. You will find a detailed description of the individual parameters in Chapter 3.9.

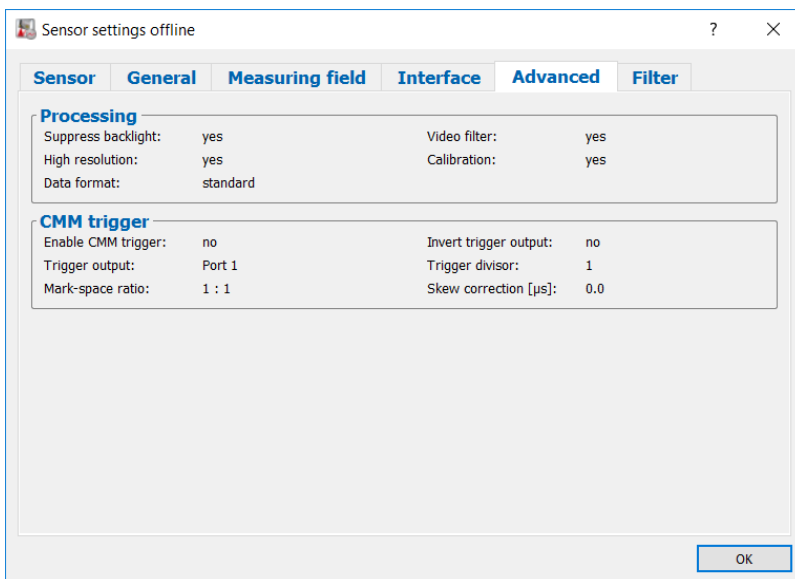


Fig. 3.23: "Advanced" tab sheet in the "Scanner settings offline" dialog

Filter: The profile filter settings of scanCONTROL are displayed. You will find a detailed description of the individual parameters in Chapter 3.8.

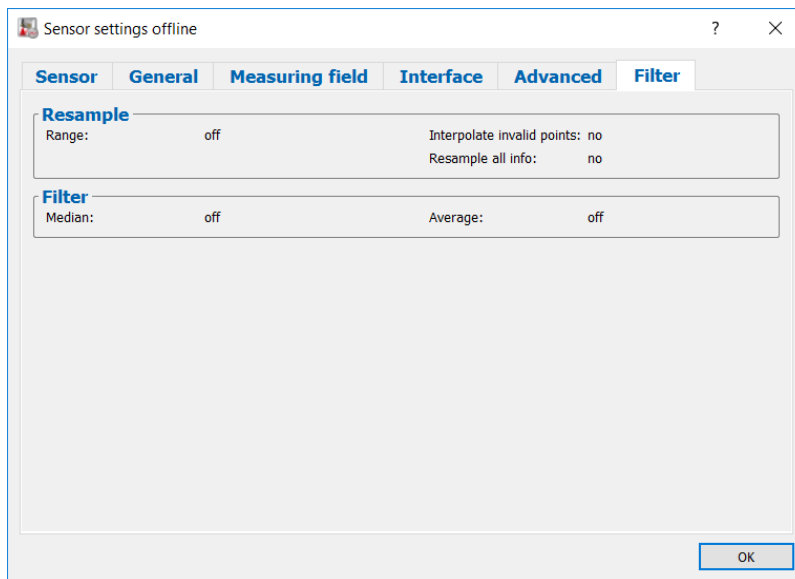


Fig. 3.24: "Filter" tab sheet in the "Scanner settings offline" dialog

Note: The following software packages save the scanCONTROL parameters:

- scanCONTROL Configuration Tools
- gapCONTROL Setup Software
- scanCONTROL 3D-View
- scanCONTROL Developer Tool
- DeveloperDemo (version 2.0 and above, option must be activated)
- scanCONTROL Result Monitor

Note: The information used during saving is only available in the file format "full set".

3.12 Mouse Interaction in the 2D-Display

scanCONTROL Configuration Tools offers several functions for mouse interaction in the 2D-display. Thus you have the possibility of scaling the 2D-display or getting detailed information about a profile point, for example. The individual modes are activated via the "Display" toolbar (see Chapter 3.17). You will find detailed descriptions of the individual options in the following.

3.12.1 Reset 2D-Display



Fig. 3.25: Button "Reset 2D-display"

Press this button in order to reset the 2D-display. Thus the settings of the 2D-display are reset so that the complete measuring field is shown and the profiles transferred by scanCONTROL are displayed.

3.12.2 Automatic Scaling of the 2D-Display



Fig. 3.26: Button "Auto scaling"

You activate or deactivate the automatic scaling of the 2D-display by pressing this button. If automatic scaling is activated, the 2D-display will be automatically adapted to the minimum and maximum coordinates of the displayed profile.

3.12.3 Keep Aspect Ratio



Fig. 3.27: Button "Keep aspect ratio"

Press this button in order to activate or deactivate the "Keep aspect ratio" option. Activating this option the display is scaled so that the real aspect ratio of the displayed profile is retained. Deactivating this option the scaling is adapted separately to the actual values for the X and Y axes.

3.12.4 Zoom in 2D-Display



Fig. 3.28: Button "Zoom"

You activate or deactivate the "Zoom" mode by pressing this button. In the "Zoom" mode you can zoom in parts of the 2D-display and so directly set the scaling of the 2D-display with your mouse. Proceed as follows:

- Move the mouse pointer to any corner of the desired range to be zoomed in.
- Now mark the range to be zoomed in. Hold the left mouse button pressed and move the mouse pointer to the opposite corner of the range to be zoomed in.
- Release the mouse button. The marked range will be zoomed in.

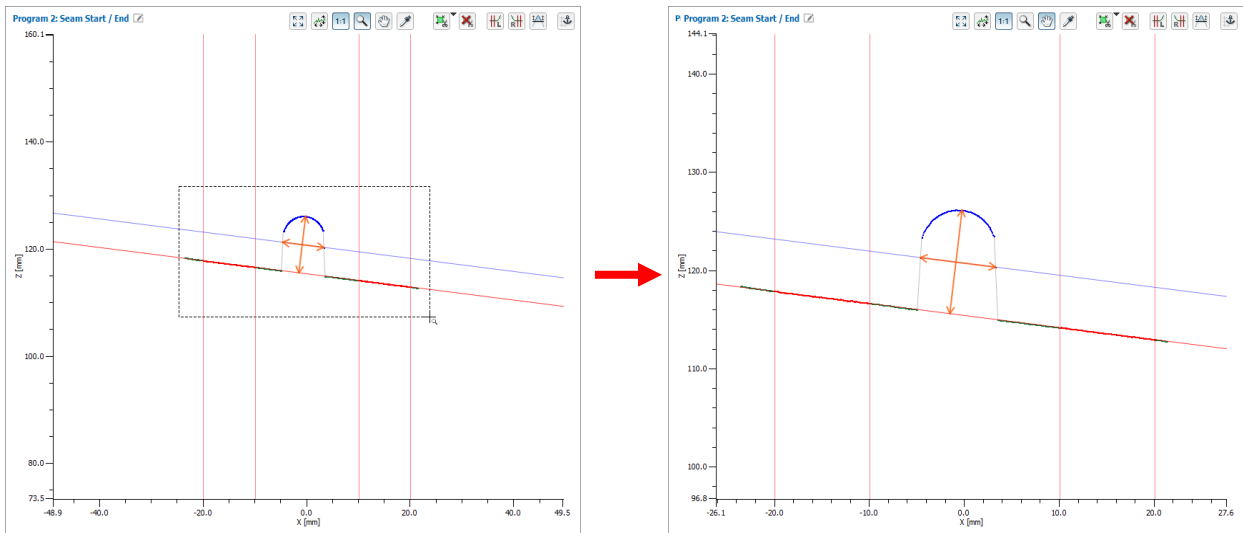


Fig. 3.29: Zoom in 2D-display

Note: Alternatively you may use the mouse wheel in order to zoom in and out the 2D-display.

As well as the mouse interaction, you also have the possibility to manually edit the scaling of the 2D-display.

- If not already done so, activate the "Zoom" mode (see above, Fig. 3.28).
- Press the right mouse button in the 2D-display.

The "Edit zoom range" dialog is displayed where you can manually edit the values of the range.

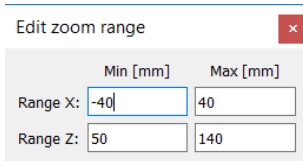


Fig. 3.30: "Edit zoom range" dialog box

3.12.5 Move Profile



Fig. 3.31: Button "Move"

You activate or deactivate the "Move profile" mode by pressing this button. You can move the profile on the 2D-display with an active "Move profile" mode. Proceed as follows:

- Move the mouse pointer into the 2D-display.
- Press the left mouse button and keep it pressed.
- Now move the mouse pointer in order to move the profile.

3.12.6 Display Extended Information of a Profile Point



Fig. 3.32: Button "Point information"

Press this button to activate or deactivate the "Display extended information of a profile point" mode. Proceed as follows:

- Move the mouse pointer onto the desired profile point.
- Hold the left mouse button pressed on the profile point.

The information for the point will now be displayed in a tooltip next to the mouse pointer.



Fig. 3.33: Extended information of a profile point

The following information is displayed:

- **X:** The X coordinate of the point.
- **Z:** The Z coordinate of the point.
- **Intensity:** The maximum intensity of the reflection from which the point has been calculated.
- **Width:** The width of the reflection from which the point has been calculated.

3.13 Configuring the Measurement

In order to perform the desired measurements in the individual measuring programs, you must set measuring ranges and threshold values. Thereby, the setting options in the individual measuring programs vary. The configuration of the measurement is divided into five steps:

- Specify the measurement task (optional, depending on the measuring program).
- Cutting out (optional): Selection of a range in which the measurement should be performed.
- Determination of (reference) straight lines.
- Set a minimum height/depth (optional, depending on the measuring program).
- Setting and activating the dynamic tracking of the ranges (optional).

3.13.1 Specifying the Measurement Task

Some measuring programs require a more exact specification of the measurement task. You can make this specification in the corresponding input fields of the individual measuring programs (see Fig. 3.34). The specification of the measurement task is explained in the following using the "Single Offset" example.

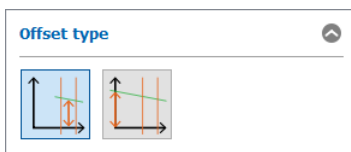


Fig. 3.34: "Offset type" input field in the "Single offset" measuring program

The "Single Offset" measuring program is used for the measurement of the offset of a line. In the "Offset type" input field you select the algorithm for calculating the offset (Z coordinate of the barycenter of the points located in the fitting range or Z coordinate of the intersection point of the line with the Z axis).

3.13.2 Cutting Out

The individual measuring programs provide the possibility to specify a range in which the measurement should take place and to hide the rest of the measuring field. Profile points which are outside the range will not be considered for the measurement and are displayed in grey. This step is necessary, for example, if parts of the mounting of the measurement object or the supporting surface of the target are located in the measuring field or if reflections occur which do not originate from the target. There are two modes available:

- **Select inside points:** Define a rectangular range in the 2D-display. Profile points which are inside the range will be considered for the measurement. Profile points which are outside the range will not be considered.
- **Select outside points:** Define a rectangular range in the 2D-display. Profile points which are outside the range will be considered for the measurement. Profile points which are inside the range will not be considered.

If there are no interfering influences in the profile, you can skip this step and use the complete measuring range for the measurement.

Proceed as follows to select the mode (Select inside/outside points) for cutting out:

- Open the "Options for region of interest" context menu. To do this, press the corresponding button located right to the "Set region of interest" button (see Fig. 3.35)

➡ Use the context menu to select the desired mode (see Fig. 3.35)

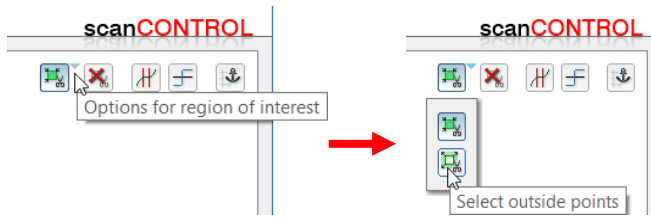


Fig. 3.35: "Options for region of interest" context menu (Select inside points/Select outside points)

Note: The "select inside points" mode is active in the default settings.

After selecting the mode for cutting out you may specify the range for the measurement:

If not already done, press the button "Set region of interest" (see Fig. 3.36) in the "Measurement" toolbar. You are now in the "Set region of interest" mode. The button remains pressed and the measuring range is shown dark green in the 2D-display if it is located in the displayed range.



Fig. 3.36: "Set region of interest" button (Select inside points/Select outside points)

Note: The default setting is that the range for the measurement is larger than the range shown in the 2D-display. Thus, the range for the measurement is initially not visible after activating the "Set region of interest" mode.

You can now set the measuring range in the 2D-display with the mouse. There are two possibilities for doing this:

- Setting the range:
 - ➡ Move the mouse pointer to any corner of the range you want to set.
 - ➡ Now mark the range to be modified. Press the left mouse button and keep it pressed. Move the mouse pointer to the opposite corner of the range you want to set.
 - ➡ Release the mouse button. The selected range will now be applied.

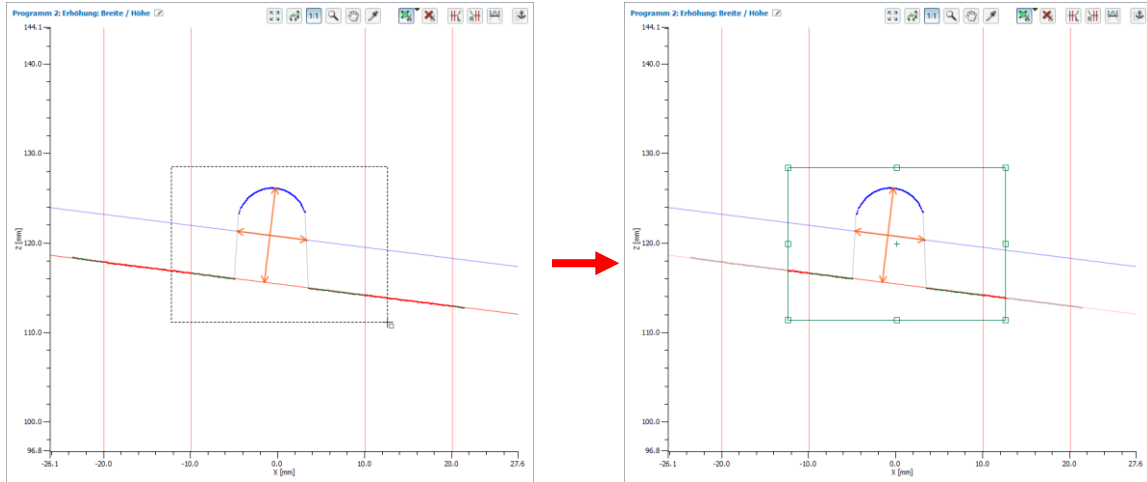


Fig. 3.37: Setting complete measuring range

- Changing the range (drag and drop):
 - ➡ Move the mouse pointer to any corner or side of the displayed range so that the mouse pointer is located in one of the small marking rectangles.
 - ➡ Press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position. The side or corner of the range changes with the position of the mouse pointer.
 - ➡ Release the mouse button.

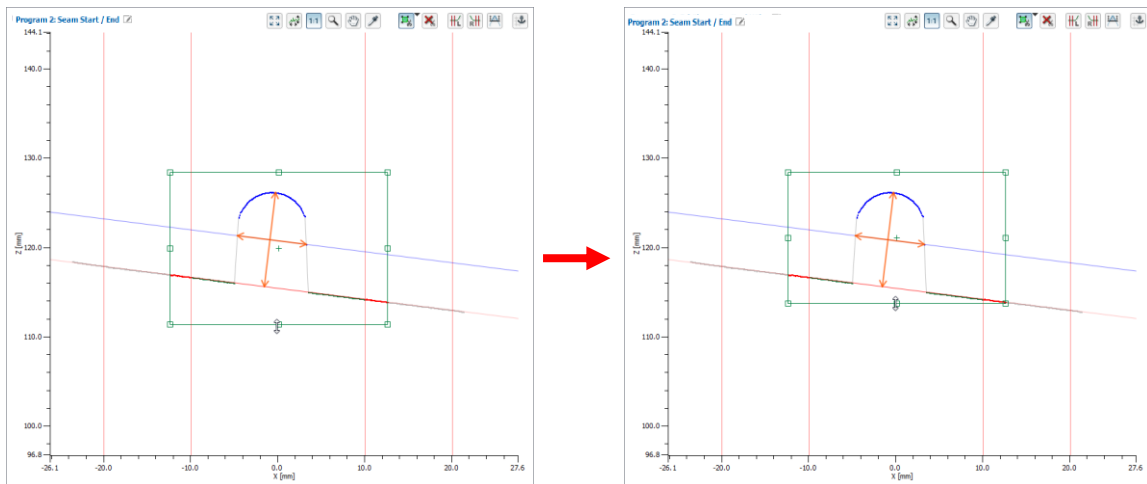


Fig. 3.38: Changing measuring range

As well as the mouse interaction, you also have the possibility to manually edit the values for the range in which the measurement should take place and to adopt the values from another measuring program.

- If not already done so, activate the "Set Region of Interest" mode (see above, Fig. 3.36).
- Press the right mouse button in the 2D-display.

The "Edit region of interest" dialog will be displayed.

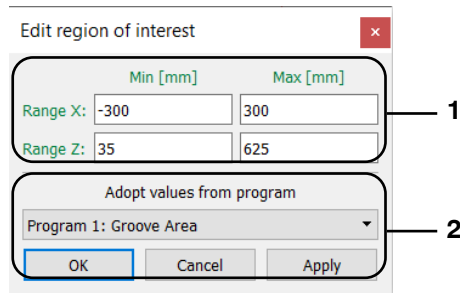


Fig. 3.39: "Edit region of interest" dialog box

- 1 Range X / Range Z:** You may manually edit the values for the range in which the measurement should take place.
- 2 Adopt values from program:** Select the measuring program whose measurement range should be adopted. Press the "OK" or "Apply" button in order to adopt the values.

Note: In case of an active dynamic tracking of the range for measurement (see Chap. 3.13.6), the values in the "Range X /Range Z" input fields are specified relative to the anchor point.

3.13.3 Remove Range for Cutting Out

By using the "Reset region of interest" button (see Fig. 3.40) you will remove the range for cutting out (see Chap. 3.13.2) and use the complete measuring range for the measurement again.



Fig. 3.40: "Reset region of interest" button

3.13.4 Setting Straight Lines

In order to be able to perform measurements in the individual measuring programs, you must define ranges in which straight lines can be fitted to the points from the profile. These straight lines are used for example for the angle measurement as the basis for determination of the angle or for the weld measurement as reference lines where, for example, the height is measured. A more detailed description can be found in the respective Chapters for the individual measuring programs. Proceed as follows in order to specify the range/ranges for the line fitting.

If not already done, press one of the "Set reference line" buttons (see Fig. 3.41) in the "Measurement" toolbar. There are various buttons, depending on the measuring program, for the line fitting. After you have pressed a button, you are in the "Set reference line" mode. The button remains pressed and the range for line fitting is shown with red and blue vertical lines in the 2D-display if it is located in the displayed range.



Fig. 3.41: "Set reference line" buttons

You can now set the range for the line fitting in the 2D-display with the mouse. There are two possibilities for doing this:

- Setting the range:
 - Move the mouse pointer to the left or right side of the range you want to set.
 - Now mark the range to be modified. Press the left mouse button and keep it pressed. Move the mouse pointer to the opposite side of the range you want to set.
 - Release the mouse button. The selected range will now be applied.

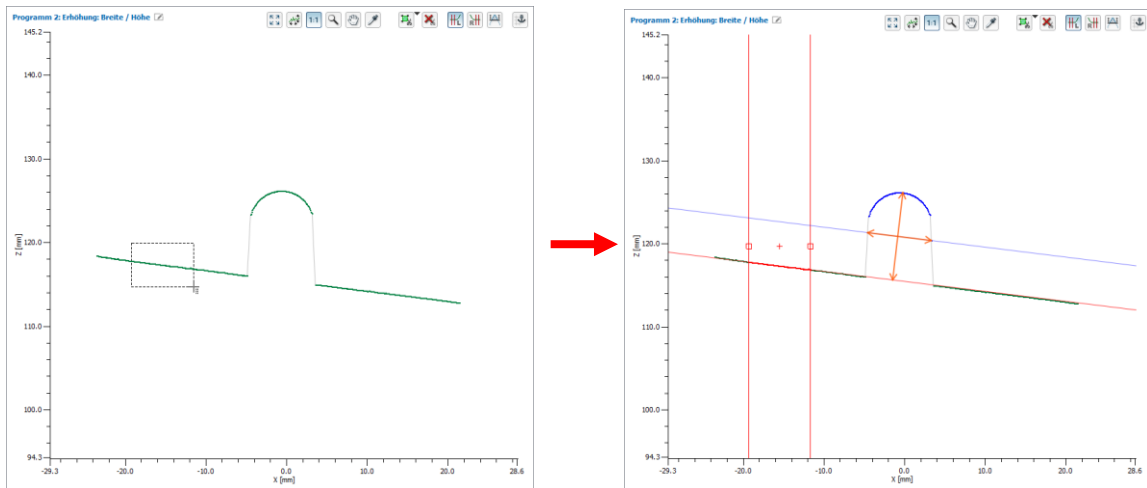


Fig. 3.42: Setting complete range for the line fitting

- Changing the range (drag and drop):

- Move the mouse pointer to the right or left side of the displayed range so that the mouse pointer is located in one of the small marking rectangles.
- Press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position. The side of the range is moved with the mouse pointer.
- Release the mouse button.

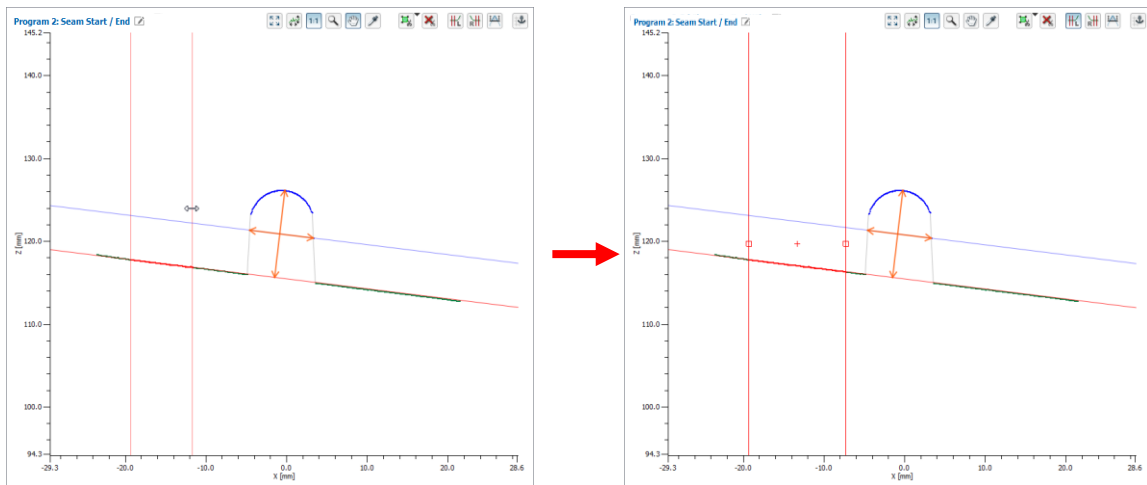


Fig. 3.43: Changing the range for the line fitting

As well as the mouse interaction, you have the possibility to manually edit the values for the range for the line fitting and to adopt the values from another measuring program.

- If not already done so, activate the "Set reference line" mode (see above, Fig. 3.41).
- Press the right mouse button in the 2D-display.

The "Edit reference" dialog will be displayed.

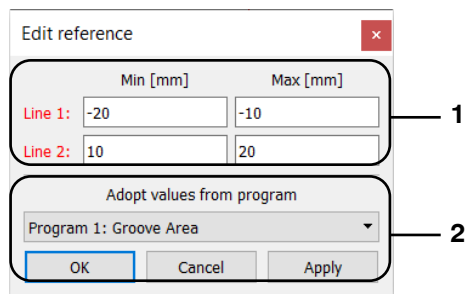


Fig. 3.44: "Edit reference" dialog box

- 1 **Line 1 / Line 2:** You may manually edit the values for the range for line fitting.
- 2 **Adopt values from program:** Select the measuring program whose range for line fitting should be adopted. Press the "OK" or "Apply" button in order to adopt the values.

Note: In case of an active dynamic tracking of the range for line fitting (see Chap. 3.13.6), the values in the "Line 1/Line 2" input fields are specified relative to the anchor point.

3.13.5 Setting a Minimum Height

It is necessary to specify a minimum height for the measurement in some measuring programs. For example, for the measurement of a weld, only those points whose distance from the reference line is greater than the minimum height are considered for the measurement. A more detailed description can be found in the respective Chapters for the individual measuring programs. Proceed as follows in order to specify the minimum height for the measurement:

If not already done, press the button "Set minimum height" (see Fig. 3.45) in the "Measurement" toolbar. You are now in the "Set minimum height" mode. The button remains pressed and the minimum height is shown in the 2D-display as a blue line parallel to the reference line.



Fig. 3.45: "Set minimum height" button

You can now set the minimum height for the measurement with the mouse. Proceed as follows:

- Move the mouse pointer on the blue line which represents the minimum height.
- Press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position. The minimum height is moved with the mouse pointer.
- Release the mouse button.

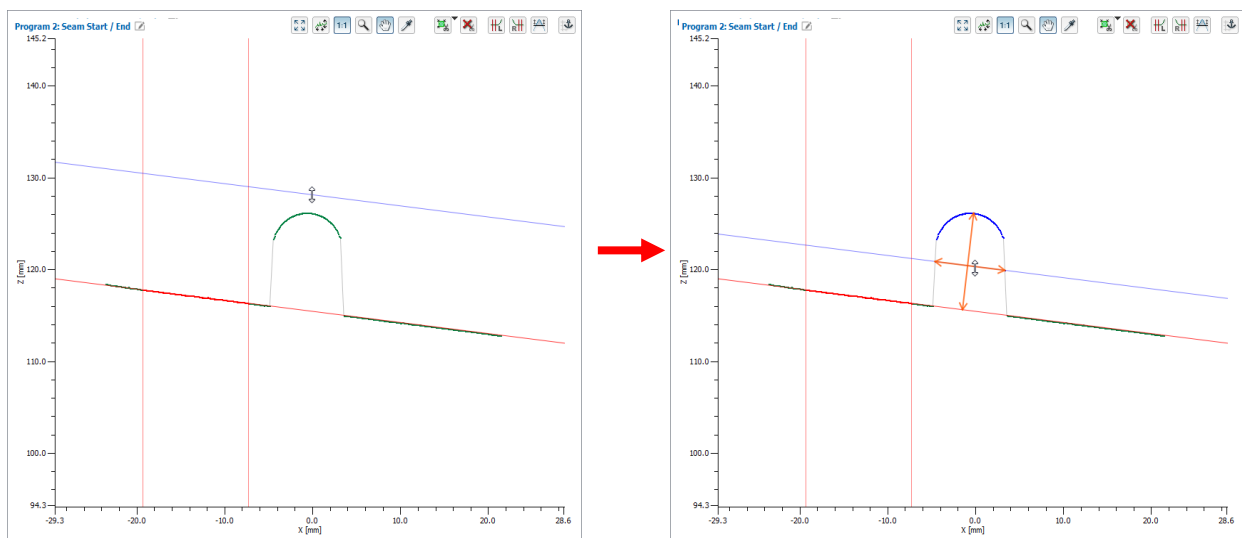


Fig. 3.46: Setting minimum height

As well as the mouse interaction, you have the possibility to manually edit the minimum height and to adopt the height from another measuring program.

- If not already done so, activate the "Set minimum height" mode (see above, Fig. 3.45).
- Press the right mouse button in the 2D-display.

The "Edit threshold" dialog will be displayed.

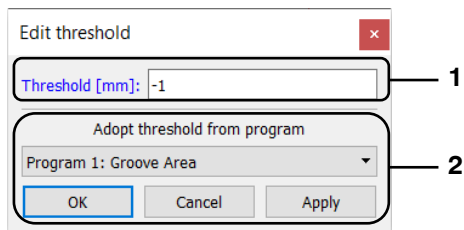


Fig. 3.47: "Edit threshold" dialog box

- 1 Threshold:** You may manually edit the minimum height.
- 2 Adopt threshold from program:** Select the measuring program whose minimum height should be adopted. Press the "OK" or "Apply" button in order to adopt the value.

3.13.6 Activating the Dynamic Tracking of the Ranges

scanCONTROL Configuration Tools makes it possible for you to dynamically track the range for cutting out, the ranges for the line fitting and the measurement ranges resulting from these. In this way, the measurement can also be performed correctly in case of position change in the X/Z direction, e.g. for curves of the beading track or bulges and indentations in the material. The ranges are coupled to an assigned point of the profile, the so-called anchor point, for the dynamic tracking. This point is also used as a reference characteristic in order to create orientation at the target.



Fig. 3.48: "Dynamic tracking" button

Proceed as follows in order to parameterize and activate the dynamic tracking:

- Set the ranges for the line fitting (see Chapter 3.13.4) and, if necessary, the range for cutting out (see Chapter 3.13.2).
- Press the "Dynamic tracking" button in the "Measurement" toolbar (see Fig. 3.48).

The "Dynamic tracking" dialog is displayed (see Fig. 3.49). The potential candidates for the anchor point are highlighted in turquoise in the 2D-display (see Fig. 3.51).

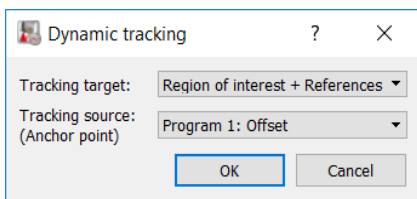


Fig. 3.49: "Dynamic tracking" dialog box

Make the following settings:

- **Tracking target:** Select the measurement ranges to be tracked:
 - **Region of interest:** The range for cutting out.
 - **References:** The ranges for line fitting.
 - **Region of interest + References:** The range for cutting out and the ranges for line fitting.

Note: The "Region of interest" and "Region of interest + References" options are only available if there are active measuring programs being processed previously to the current measuring program and providing anchor points.

Note: If using the "Maximum point", "Minimum point", "First point" or "Last point" measuring program, only the "Region of interest" option is available.

- **Tracking source (Anchor point):** Select the anchor point. The following options are available:
 - **Measurement results:** Points which are provided as anchor points by previous measuring programs.
 - **Extreme points:** The extreme points inside the range for cutting out of the current measuring program (First, Last, Minimum, Maximum Point). The extreme points are only available if the "Tracking target" parameter is set to "References".

Note: The following dialog is displayed in case of no anchor points being available:

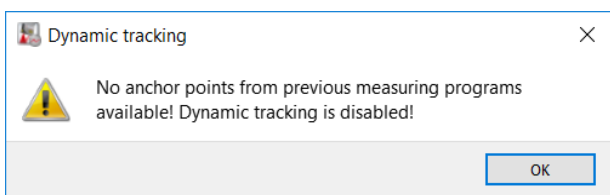


Fig. 3.50: Information dialog box in case of missing anchor points

An overview of the available measuring programs which are providing anchor points is shown below:

- Maximum Point
- Minimum Point
- First Point
- Last Point
- Absolute Angle/Offset (if using "Center of gravity")
- Intersection Point
- Single Offset (if using "Center of gravity")
- Double Offset (if using "Center of gravity")
- Edge Left
- Edge Right
- Surface Maximum
- Surface Minimum
- Seam Start/End
- Seam Maximum
- Groove Start/End
- Groove Minimum
- Gap Start/End
- Gap Center Point
- Circle Vertex
- Circle Seam Start/End
- Circle Seam Maximum
- Circle Groove Start/End
- Circle Groove Minimum

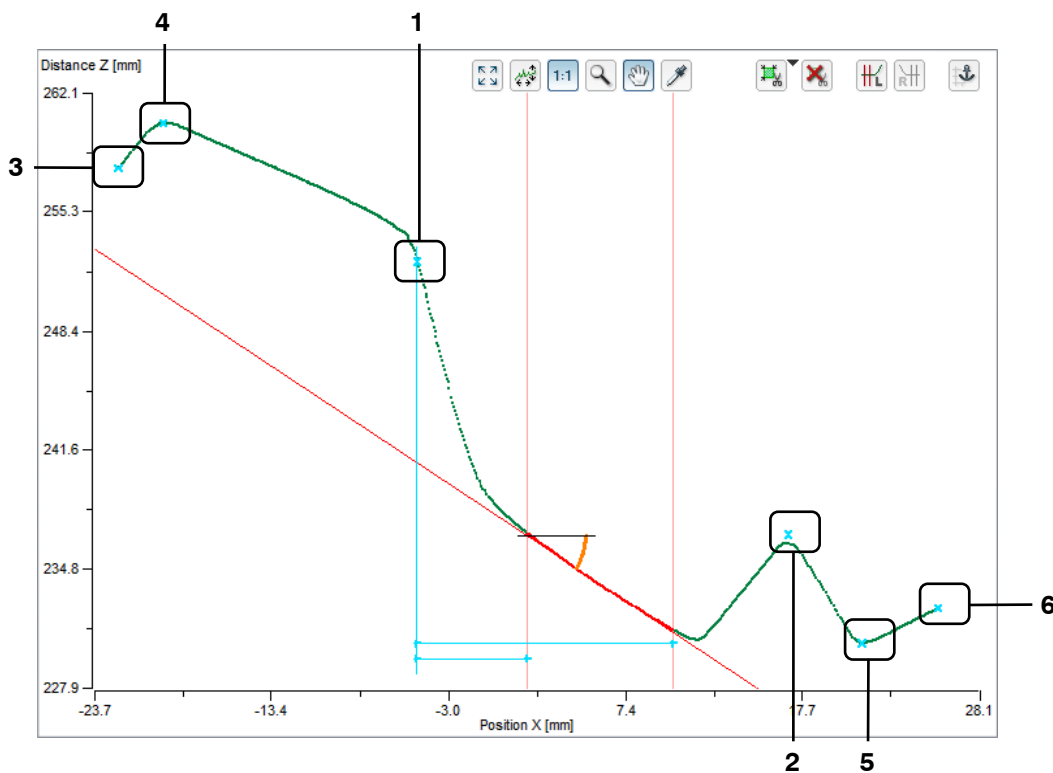



Fig. 3.51: Possible candidates for the anchor point

1-2: Results from previous measuring programs.

3-6: Extreme points of the current measuring program.

 In the "Dynamic tracking" dialog (see Fig. 3.49), select the ranges to be tracked and the desired anchor point and confirm with "OK".

The dynamic tracking is now active. The "dynamic tracking" button (see Fig. 3.48) remains pressed. The coupling of the ranges to the anchor point is symbolized with turquoise lines in the 2D-display.

In order to deactivate the dynamic tracking, press the "Dynamic tracking" button again (see Fig. 3.48). The dynamic tracking is now deactivated.

3.14 Saving and Loading Parameters

Configuration Tools allows you to save and load parameters. For example, you can save parameters for different measuring settings and therefore configure the measurement system for different measuring tasks. In addition, you can also specify different tolerances for a single measuring task. You can simplify the configuration of a new measuring task by making stepwise refinements.

Once you have saved all the parameters for measurement settings you can load them again later on. You can save the parameters for as many measuring tasks as you like.

3.14.1 Saving Parameters to File

In order to save the parameters of all active measuring programs, either select the menu item "Parameters → Save parameters to file" or press the corresponding button (see Fig. 3.52) in the "General" toolbar.



Fig. 3.52: "Save parameters to file" button

A standard Windows dialog is displayed for selection of the path and file name for saving the parameters. As standard, the file name has the extension ".sc1". You can use a different file extension by selecting the "All files (*.*)" option in the Windows dialog in the "File type" selection field. The parameters are saved in the selected file after confirmation of the dialog.

Note: Saving parameters to file is not available in the "Display Image Data" view and in the main view.

3.14.2 Loading Parameters from File

In order to load previously saved parameters of measuring programs, either select the menu item "Parameters → Load parameters from file" or press the corresponding button (see Fig. 3.53) in the "General" toolbar.



Fig. 3.53: "Load parameters from file" button

A standard Windows dialog is displayed for selection of the path and file name from which the parameters should be loaded. As standard, the file name has the extension ".sc1". You can use a different file extension by selecting the "All files (*.*)" option in the Windows dialog in the "File type" selection field. The parameters are loaded after confirmation of the dialog.

Note: Use the "Recent parameters" menu item to load and apply previously saved or loaded parameters.

Note: In case of loading parameters which don't contain the active measuring program or if the position of the program doesn't match with the position in the loaded parameter set, a warning dialog appears. After confirming the dialog Configuration Tools returns to the Main View and loads the desired parameter file.

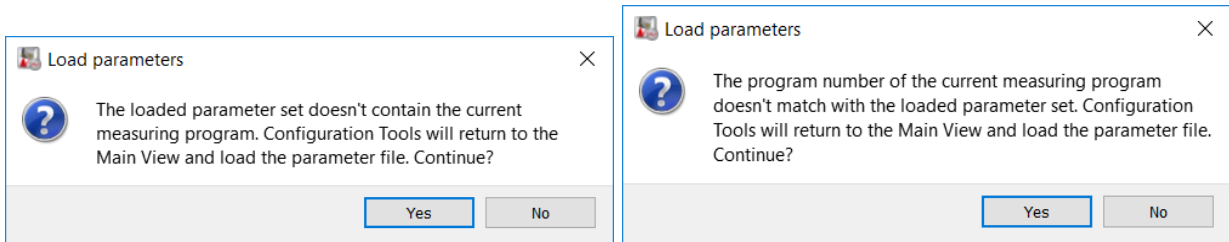


Fig. 3.54: Warning dialog "Load parameters"

3.14.3 Reset Parameters to Default Settings

In order to reset the parameters of the current measuring program and of all active measuring programs respectively to their default settings, either select the menu item "Parameters → Reset" or press the corresponding button (see Fig. 3.55) in the "General" toolbar.



Fig. 3.55: "Reset" button

A dialog is displayed (see Fig. 3.56) where you can select which parameters should be reset.

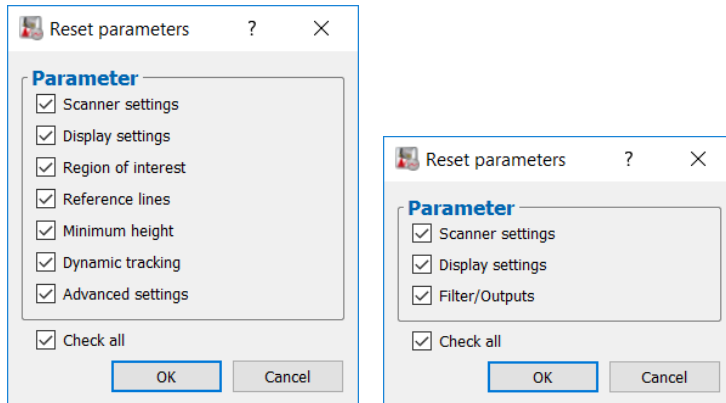


Fig. 3.56: "Reset" dialog box (Example 1: "Seam Width/Height", Example 2: "Outputs and Results")

The following parameters can be reset:

- **Scanner settings:** The parameters of the scanCONTROL measurement system (see Chapter 3.7, 3.8, 3.9).
 - **Display settings:** The settings of the 2D-display (see Chapter 3.12).
 - **Region of interest:** The range for cutting out a profile (see Chapter 3.13.2).
 - **Reference lines:** The range for determination of the (reference) straight lines (see Chapter 3.13.4).
 - **Minimum height:** The threshold value for the detection of significant profile sections (see Chapter 3.13.5).
 - **Dynamic tracking:** The settings for the dynamic tracking of the search ranges (see Chapter 3.13.6).
 - **Gap settings:** The settings for gap detection (see Chapter 4.7).
 - **Advanced settings:** The advanced settings of the measuring program (see Chapters 4.3.4, 4.3.5, 4.5, 4.6).
 - **Combined signals:** The signals for combining measured values (see Chapter 5).
 - **Filter/Outputs:** The settings for filtering measured values (see Chapter 6.1) and for evaluation and output of the measured values (see Chapter 6.2, 6.3, 6.4, 6.5, 6.6 and 6.7).
 - **Result monitor:** The settings for the statistical evaluation of measured values (see Chapter 7).
- ➡ Press the "Check all" button in order to select all parameter types. Press the "Check all" button in order to deselect all parameter types again.
- ➡ Press "OK" in order to reset the selected parameters.

Note: The possible settings in the "Reset" dialog vary depending on the measuring program.

3.14.4 Store Parameters permanently on scanCONTROL

Configuration Tools makes it possible for you to permanently store the parameters of all active measuring programs and the configuration of the output ports on the connected scanCONTROL measurement system. So, in combination with the scanCONTROL Smart product series which operates as an independent unit and without a connected PC, measurements can also be performed after a failure and recovery of the power supply without having to connect the measurement system to the PC again.

Note: Saving parameters to scanCONTROL is not available in the "Display Image Data" view and in the main view.

In order to save the parameters of all active measuring programs and the configuration of the output ports on the connected scanCONTROL Smart measurement system, either select the menu item "Parameters → Save parameters to scanCONTROL" or press the corresponding button (see Fig. 3.57) in the "General" toolbar.



Fig. 3.57: "Save parameters to scanCONTROL" button

The "Save user mode" dialog (see Fig. 3.58) is displayed. In this dialog, select the storage location on the scanCONTROL measurement system where the current parameters should be saved. These storage locations are called "User modes". The maximum number of "User modes" is 15. The parameters are saved in the selected user mode after confirmation of the dialog.

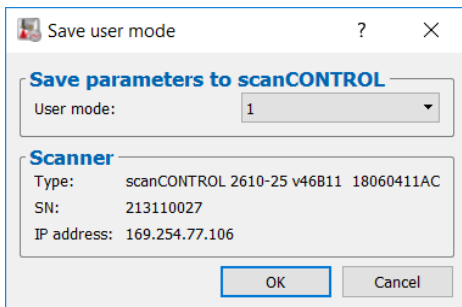


Fig. 3.58: "Save user mode" dialog box

Note: Details for loading a user mode can be found in Chapter 3.14.5, 8.3 and in the instruction manual of the measurement system used.

Note: In case of using the scanCONTROL Compact or scanCONTROL High-Speed product series, only the parameters located in the "Scanner settings" (see Chapter 3.7, 3.8 and 3.9) section are stored. In order to save all measurement parameters please use the scanCONTROL Smart product series.

Note: The "Digital input resistor" parameter (see Chapter 3.9, "Interface" tab) is not permanently stored in the selected user mode on the scanCONTROL measuring system.

3.14.5 Load Parameters from scanCONTROL

Use the "Load parameters from scanCONTROL" function in order to read the current parameter settings or parameter settings which have been saved on the measurement system (see Chapter 3.14.4) back into the software. To do this, either select the menu item "Parameters → Load parameters from scanCONTROL" or press the corresponding button (see Fig. 3.59) in the "General" toolbar.

Note: Loading parameters from scanCONTROL is only available in the main view and in the "Result Combination", "Outputs and Result" and "Result Monitor" views.



Fig. 3.59: "Load parameters from scanCONTROL" button

The "Load user mode" dialog appears. Select the parameter set (User mode) or the current parameter settings to load. After you have confirmed the dialog with OK, the selected parameters on the scanCONTROL measurement system are activated and the software reads the parameter set from the measurement system and returns to the recently opened view.

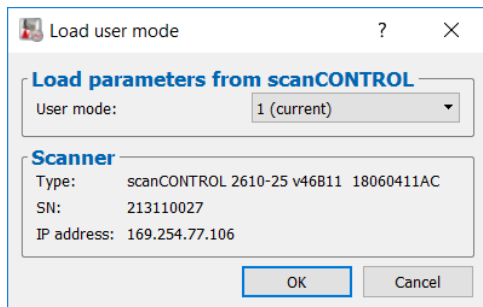


Fig. 3.60: "Load user mode" dialog box

If the parameters couldn't be read out from the selected user mode, an error message appears.

In the following possible warning and error messages and their reasons are listed:

- The selected user mode contains no measuring parameters. You can only read user modes which were saved with the function "Save parameters to scanCONTROL" (see Chapter 3.14.4).
- You are using the scanCONTROL Compact or scanCONTROL High-Speed product series. Only the parameters located in the "Scanner settings" (see Chapter 3.7, 3.8 and 3.9) section are loaded. In order to load all measurement parameters please use the scanCONTROL Smart product series.
- The scanCONTROL firmware doesn't support saving and reading user modes. To be able to use this function, scanCONTROL requires a firmware ≥ 24 .
- An older version of scanCONTROL Configuration Tools was used to store the parameters. Only parameters stored with version 2.0 and above can be read out.
- The number of points per profile stored in the user mode is too small. Only user modes stored with a sufficient number of points per profile can be read out.

Note: The "Digital input resistor" parameter (see Chapter 3.9, "Interface" tab) is not considered when loading parameters from the scanCONTROL measuring system.

3.14.6 Backup parameter sets from scanCONTROL to a file

Use the "Parameters → Backup user modes to file" menu entry in order to save all parameter sets, which are stored on the scanCONTROL measurement system (user modes) (see Chapter 3.14.4) to a file.

A standard Windows dialog is displayed for selection of the path and file name for saving the parameters. As standard, the file name has the extension ".bin". The parameters are saved in the selected file after confirmation of the dialog. The progress of the process is showed in an information dialog box.

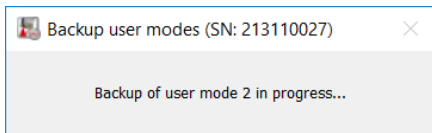


Fig. 3.61: "Backup user modes" dialog box

Note: Backing up user modes is only available in the main view (see Chapter 3.2).

Note: The "Digital input resistor" parameter (see Chapter 3.9, "Interface" tab) is not permanently stored in the user modes on the scanCONTROL measuring system.

3.14.7 Restore backed parameter sets from a file to scanCONTROL

Use the "Parameters → Restore user modes from file" menu entry in order to restore saved parameter sets (user modes, see Chapter 3.14.6) to the scanCONTROL measurement system.

A standard Windows dialog is displayed for selection of the path and file name from which the parameters should be restored. As standard, the file name has the extension ".bin". After the file selection, you have the option to specify whether the calibration of the mounting position (see Chapter 4.11.4) should be transferred to the connected scanner (see Fig. 3.62).

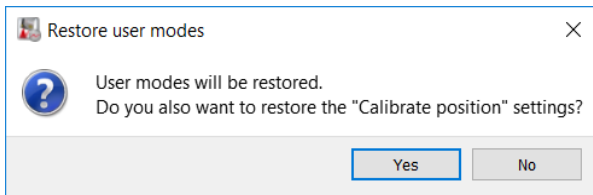


Fig. 3.62: "Restore calibrate position" dialog box

After confirming the dialog, the parameters of the selected file are read and transferred to the connected scanCONTROL measurement system. Empty parameter sets (user modes) are filled with the factory settings. The progress of the process is showed in an information dialog box.

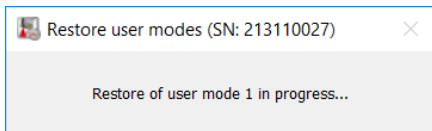


Fig. 3.63: "Restore user modes" dialog box

Subsequently, the parameters transmitted to the connected measuring system are verified.

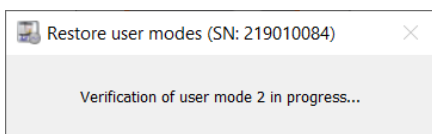


Fig. 3.64: "Verification user modes" dialog box

Note: The settings can be restored only if the same type of measurement system was used when saving the settings.

Note: Restoring user modes is only available in the main view (see Chapter 3.2).

Note: When you restore user modes from a file all existing user modes on the scanCONTROL measurement system will be overwritten.

Note: The "Digital input resistor" parameter (see Chapter 3.9, "Interface" tab) is not considered when restoring user modes from the scanCONTROL measuring system.

3.15 Menu Bar

A summary of the menu bar functions (see Fig. 3.65) can be seen in the following.

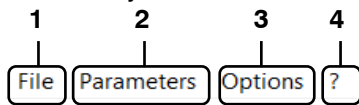


Fig. 3.65: Menu bar

1 - File:

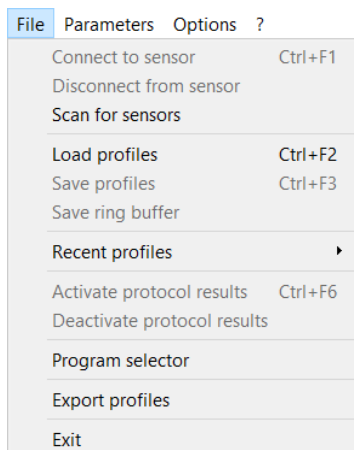


Fig. 3.66: "File" menu

- **Connect to sensor:** Selects the scanCONTROL measurement system connected to the PC as data source (see Chapter 3.5).
- **Disconnect from sensor:** Disconnects the scanCONTROL measurement system.
- **Scan for sensors:** Identifies all measurement systems which located in the same subnet as the PC. This function is performed automatically when you start the software. Depending on the "Connect to sensor" setting (see Chapter 3.20), the software automatically connects to a scanCONTROL measurement system (see Chapter 3.5.1) or you can select a measuring system (see Chapter 3.5.2).
- **Load profiles:** Selects a file in which profiles have been saved previously as data source (see Chapter 3.5).
- **Save profiles:** Saves profiles which are transferred by scanCONTROL to a file (see Chapter 3.6.1).
- **Save ring buffer:** Saves profiles from the ring buffer to a file (see Chapter 3.6.2).
- **Recent profiles:** Loads previously saved or loaded profile sequences.
- **Activate protocol results:** Activates the logging of measured values (see Chapter 6.9).
- **Deactivate protocol results:** Deactivates the logging of measured values (see Chapter 6.9).
- **Program selector:** Closes the current measuring program and returns to the Main View (see Chapter 3.2).
- **Export profiles:** Starts the "Export profiles" program (see Chapter 4.12).
- **Exit:** Closes scanCONTROL Configuration Tools (see Chapter 3.22).

2 - Parameters:

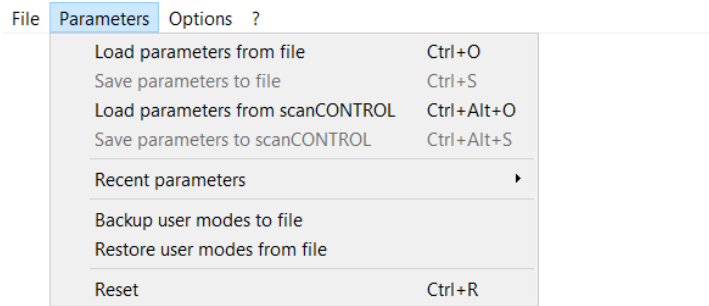


Fig. 3.67: "Parameters" menu

- **Load parameters from file:** Loads parameters of measuring programs from a file (see Chapter 3.14.2).
- **Save parameters to file:** Saves the parameters of all active measuring programs to a file (see Chapter 3.14.1).
- **Load parameters from scanCONTROL:** Loads parameters which have been saved on the scanCONTROL measurement system (see Chapter 3.14.5).
- **Save parameters to scanCONTROL:** Saves the parameters of all active measuring programs permanently on the scanCONTROL measurement system (see Chapter 3.14.4).
- **Recent parameters:** Loads previously saved or loaded parameters.
- **Backup user modes to file:** Backs up all parameter sets stored on the measuring system (user modes) to a file (see Chapter 3.14.6).
- **Restore user modes from file:** Restores saved parameter sets (user modes) from a file to the scanCONTROL measurement system (see Chapter 3.14.7).
- **Reset:** Resets the parameters to default settings (see Chapter 3.14.3).

3 - Options:

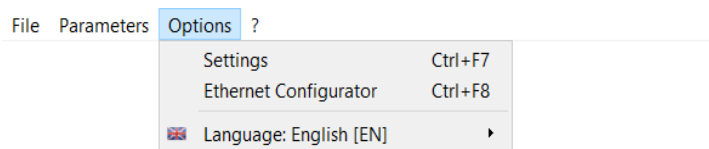


Fig. 3.68: "Options" menu

- **Settings:** Activates a dialog where you can make basic settings (see Chapter 3.20).
- **Ethernet configurator:** Activates a dialog where you can modify the network settings of scanCONTROL measurement systems (see Chapter 3.21).
- **Language:** Select the display language of Configuration Tools:
 - **english [EN]:** English.
 - **deutsch [DE]:** German.
 - **简体中文 (chinese) [CN]:** Simplified Chinese.
 - **日本語 (japanese) [JP]:** Japanese.
 - **한국어 (korean) [KO]:** Korean.

4 - ?:

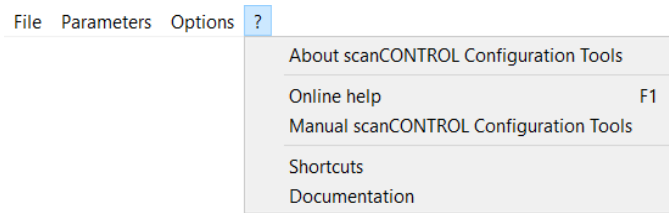


Fig. 3.69: "?" menu

- **About scanCONTROL Configuration Tools:** Displays an information window about scanCONTROL Configuration Tools.
- **Online help:** Opens the documentation for the current view.
- **Manual scanCONTROL Configuration Tools:** Opens the instruction manual of scanCONTROL Configuration Tools.
- **Shortcuts:** Opens an overview of the available key shortcuts (see Chapter 9.3).
- **Documentation:** Opens an overview where you can call up various help and documentation about scanCONTROL.











Note: Using the function key <F1> or the "?" button in the title bar of each option dialog, you can open the documentation for the current view.

3.16 Functions of the "General" Toolbar

A summary of the functions of the "General" toolbar (see Fig. 3.70) can be seen in the following.



Fig. 3.70: "General" toolbar

-  Selects the scanCONTROL measurement system connected to the PC as data source (see Chapter 3.5).
-  Selects a file in which profiles have been saved previously as data source (see Chapter 3.5).
-  Saves profiles which are transferred by scanCONTROL to a file (see Chapter 3.6.1).
-  Saves profiles from the ring buffer to a file (see Chapter 3.6.2).
-  Activates/Deactivates the logging of measured values (see Chapter 6.9).
-  Loads parameters of measuring programs from a file (see Chapter 3.14.2).
-  Saves the parameters of all active measuring programs to a file (see Chapter 3.14.1).
-  Loads parameters which have been saved on the scanCONTROL measurement system (see Chapter 3.14.5).
-  Saves the parameters of all active measuring programs permanently on the scanCONTROL measurement system (see Chapter 3.14.4).
-  Resets parameters to default settings (see Chapter 3.14.3).









3.17 Functions of the "Display" Toolbar

A summary of the functions of the "Display" toolbar (see Fig. 3.71) can be seen in the following.



Fig. 3.71: "Display" toolbar














Note: The elements of the "Display" toolbar vary depending on the measuring program.





-  Resets the 2D-display to the complete measuring range (see Chapter 3.12.1).
-  Activates or deactivates the automatic scaling of the 2D-display (see Chapter 3.12.2).
-  Activates or deactivates the "Keep aspect ratio" mode (see Chapter 3.12.3).
-  Activates or deactivates the "Zoom" mode (see Chapter 3.12.4).
-  Activates or deactivates the "Move profile" mode (see Chapter 3.12.5).
-  Activates or deactivates the "Display extended information of a profile point" mode (see Chapter 3.12.6).
-  Scales the 2D-display to the entire window (is only available in the "Display Image Data" program).
-  Scales the 2D-display to the original image size (is only available in the "Display Image Data" program).

3.18 Functions of the "Measurement" Toolbar

A summary of the functions of the "Measurement" toolbar can be seen in the following.

Note: The elements of the "Measurement" toolbar vary depending on the measuring program.

-  Activates or deactivates the "Cutting out" mode (Select inside points, see Chapter 3.13.2).
-  Activates or deactivates the "Cutting out" mode (Select outside points, see Chapter 3.13.2).
-  Resets the range for "Cutting out" (see Chapter 3.13.3).
-  Activates or deactivates the "Set measuring field" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Resets the "Measuring field" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Activates or deactivates the "Set second measuring field" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Resets the "Second measuring field" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Activates or deactivates the "Set region of no interest" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Resets the "Region of no interest" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Activates or deactivates the "Set reference field for auto exposure" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Resets the "Reference field for auto exposure" mode (see Chapter 3.9 "Measuring field" tab sheet, is only available in the "Display Image Data" program).
-  Activates or deactivates the "Set reference line" mode (see Chapter 3.13.4).
-  Activates or deactivates the "Set reference line (left)" mode (see Chapter 3.13.4).

-  Activates or deactivates the "Set reference line (right)" mode (see Chapter 3.13.4).
-  Activates or deactivates the "Set reference line (right)" mode (see Chapter 3.13.4).
-  Activates or deactivates the "Set minimum height" mode (see Chapter 3.13.5).
-  Activates or deactivates the dynamic tracking of the ranges (see Chapter 3.13.6).

3.19 Navigation in Configuration Tools

In scanCONTROL Configuration Tools, you can use the navigation menu to switch to the following programs and views:

- Main View (Program Selector)
- Result Combination
- Outputs and Results
- Result Monitor
- Active measuring programs
- Display Image Data
- Display Profiles
- Save Profiles

To show the navigation menu (see Fig. 3.73), click on the "Navigation" button (see Fig. 3.72)



Fig. 3.72: "Navigation" button

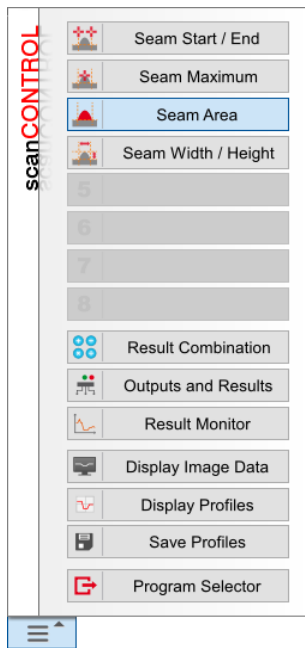


Fig. 3.73: "Navigation" menu

3.20 Basic Settings

Select the menu item "Options → Settings" to make basic settings for the software. The "Settings" dialog is displayed (see Fig. 3.74).

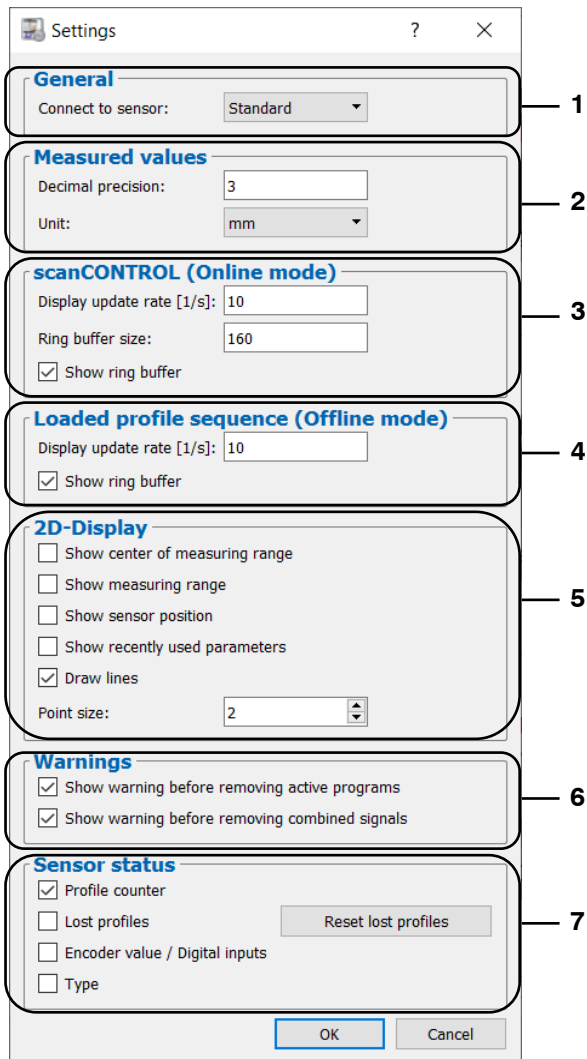


Fig. 3.74: "Settings" dialog box

Parameters in the "Settings" dialog:

1 General:

- **Connect to sensor:** Configuration Tools provides two modes for establishing a connection to the scanCONTROL measurement system (see Chapter 3.5):
 - **Standard:** Standard mode (see Chapter 3.5.1).
 - **Advanced:** Advanced mode (see Chapter 3.5.2).

2 Measured values: Configure the display of measured values.

- **Decimal precision:** Specify the number of decimal places displayed for the measured values.
- **Unit:** Specify the unit for measured values:
 - **mm:** Millimeter.
 - **µm:** Micrometer.
 - **in:** Inch.

3 scanCONTROL (Online mode):

- **Display update rate [1/s]:** Edit the update rate of the display when using a scanCONTROL measurement system.
- **Ring buffer size:** Set the size of the ring buffer (see Chapter 3.6.2).
- **Show ring buffer:** Activate the show of the profiles in the ring buffer (see Chapter 3.7).

4 Loaded profile sequence (Online mode):

- **Display update rate [1/s]:** Edit the speed at which offline profile sequences are played back.
- **Show ring buffer:** Activate the show of the loaded profile sequence (see Chapter 3.10).

5 2D-Display: Specify whether additional data are shown:

- **Show center of measuring range:** Shows the center of measuring range in the 2D-display.
- **Show measuring range:** Shows the measuring range in the 2D-display.
- **Show sensor position:** Shows the sensor position in the 2D-display.
- **Show recently used parameters:** Shows the recently used parameters in the 2D-display.
- **Draw line:** Draws a straight line between adjacent points in the 2D-display.
- **Point size:** Defines the point size in the 2D-display.

Note: In offline mode, the measuring field and the sensor position are only displayed in the "Complete" data format (see Chapter 4.11.3, Section 2) if profile sequences are loaded.

6 Warnings: Specify whether warnings are shown:

- **Show warning before removing active programs:** Shows a warning before removing a program from the active program list.
- **Show warning before removing combined signals:** Shows a warning before removing a combined signal ("Combining Results from Measuring Programs" view, see Chapter 5).

7 Sensor status: Specify the information of the scanCONTROL measurement system (see Chapter 3.7, Section 6) to be displayed additionally:

- **Profile counter:** Shows the current profile number (0 - 16777215).
- **Lost profiles:** Shows the number of lost profiles since connecting to the measurement system.
- **Encoder value / Digital inputs:** Shows the current encoder value (see Chapter 3.9, "Interface" tab, Section 6) or the assignment of the digital inputs (see Chapter 3.9, "Interface" tab, Section 4).
- **Type:** Shows the currently used type of measurement system and the associated firmware version.
- **Reset lost profiles:** Press this button in order to reset the lost profiles counter.

3.21 Adjusting scanCONTROL Network Settings (Ethernet Configurator)

You may adjust the system network settings (IP address, etc.) by selecting the "Options → Ethernet Configurator" menu item. The "Ethernet Configurator" dialog will be opened.

Note: To be able to operate a scanCONTROL measurement system via Ethernet with Configuration Tools, the measurement system and your PC must be located in the same subnet. Adjust any relevant network settings for the measurement system in the "Ethernet Configurator" dialog.

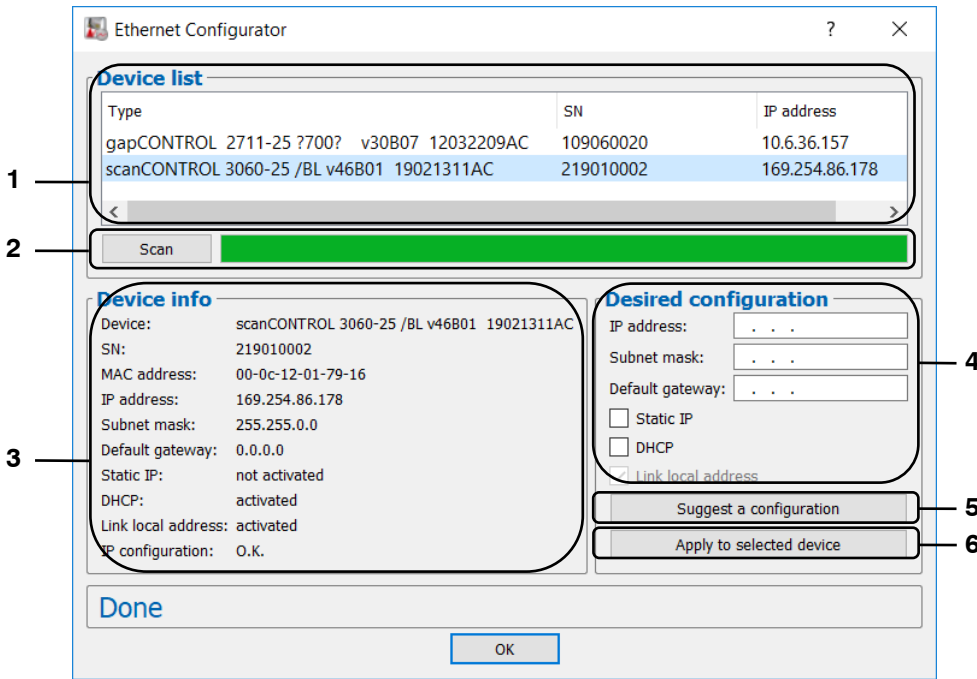


Fig. 3.75: "Ethernet Configurator" dialog

Display elements and parameters in the "Ethernet Configurator" dialog:

- 1 **Device list:** This section lists all available measurement systems. Click "Scan" to refresh the list. Select the desired measurement system.
- 2 **Scan:** Click this button to search for scanCONTROL measurement systems in all subnets connected to the PC. The scan progress is displayed. When the scanning is complete, any found measurement systems are displayed in the list.
- 3 **Device info:** Displays the current settings for the selected scanCONTROL measurement system:
 - **Device:** Device name
 - **SN:** Serial number
 - **MAC address:** Physical address
 - **IP address:** IP address
 - **Subnet mask:** Subnet mask
 - **Default gateway:** Default gateway
 - **Static IP:** "Static IP" address option enabled
 - **DHCP:** "DHCP" option enabled
 - **Link local address:** "Link local address" option enabled
 - **IP configuration:** Indicates whether the network configuration is valid. If the network configuration is not valid, the measurement system cannot be used with Configuration Tools.

- 4 **Desired configuration:** Use the following input fields to enter the network configuration for the selected scanCONTROL measurement system:
 - **IP address:** IP address
 - **Subnet mask:** Subnet mask
 - **Default gateway:** Default gateway
 - **Static IP:** "Static IP" option – if this option is enabled, dynamic address allocation is disabled. The IP address entered is used as IP address. This parameter takes precedence over the "DHCP" and "Link local address" options.
 - **DHCP:** "DHCP" option – if this option is enabled, the IP address is allocated dynamically through a DHCP server. This parameter takes precedence over "Link local address".
 - **Link local address:** "Link local address" option – if this option is enabled, the IP address is allocated dynamically in the local subnet 169.254.x.x. This option is always enabled.
- 5 **Suggest a configuration:** Click this button to have a suitable configuration for the selected scanCONTROL measurement system determined automatically. After the process is complete, the system automatically completes the input fields in the "Desired configuration" section.
- 6 **Apply to selected device:** Click this button to apply the network configuration specified in the "Desired configuration" section to the selected scanCONTROL measurement system.


Proceed as follows to manually enter the network configuration parameters for a scanCONTROL measurement system:

- When the "Ethernet Configurator" dialog is opened, the system automatically searches for available measurement systems. If the measurement system is not connected to your subnet yet, establish a connection, and click the "Scan" button. When scanning is complete, the measurement system is displayed in the device list.
- Select the required measurement system from the device list.
- Specify the required network settings in the input fields in the "Desired configuration" section.
- Click "Apply to selected device" to apply the settings to the selected measurement system.
- Click OK to confirm the selections in the "Ethernet Configurator" dialog.

Proceed as follows to automatically specify network configuration parameters for a scanCONTROL measurement system:

- When the "Ethernet Configurator" dialog is opened, the system automatically searches for available measurement systems. If the measurement system is not connected to your subnet yet, establish a connection, and click the "Scan" button. When scanning is complete, the measurement system is displayed in the device list.
- Select the required measurement system from the device list.
- Click the "Suggest a configuration" button to have a suitable network configuration for the selected scanCONTROL measurement system determined automatically. After the process is complete, the system automatically completes the input fields in the "Desired configuration" section.
- Click "Apply to selected device" to apply the settings to the selected measurement system.
- Click OK to confirm the selections in the "Ethernet Configurator" dialog.

3.22 Exiting scanCONTROL Configuration Tools

Select the menu item "File → Exit" or press the standard Windows button  in the title bar of the program window in order to exit scanCONTROL Configuration Tools.

4. Description of the Measuring Programs

The functions of the individual measuring programs are described in detail in the following. The measuring programs are split into 10 groups. Additionally a "Tools" group is available which provides useful utilities. The individual group views are activated from the Main View (see Chapter 3.2).

4.1 "Extrema" Group

Programs for determining extreme values can be found in the "Extrema" group.

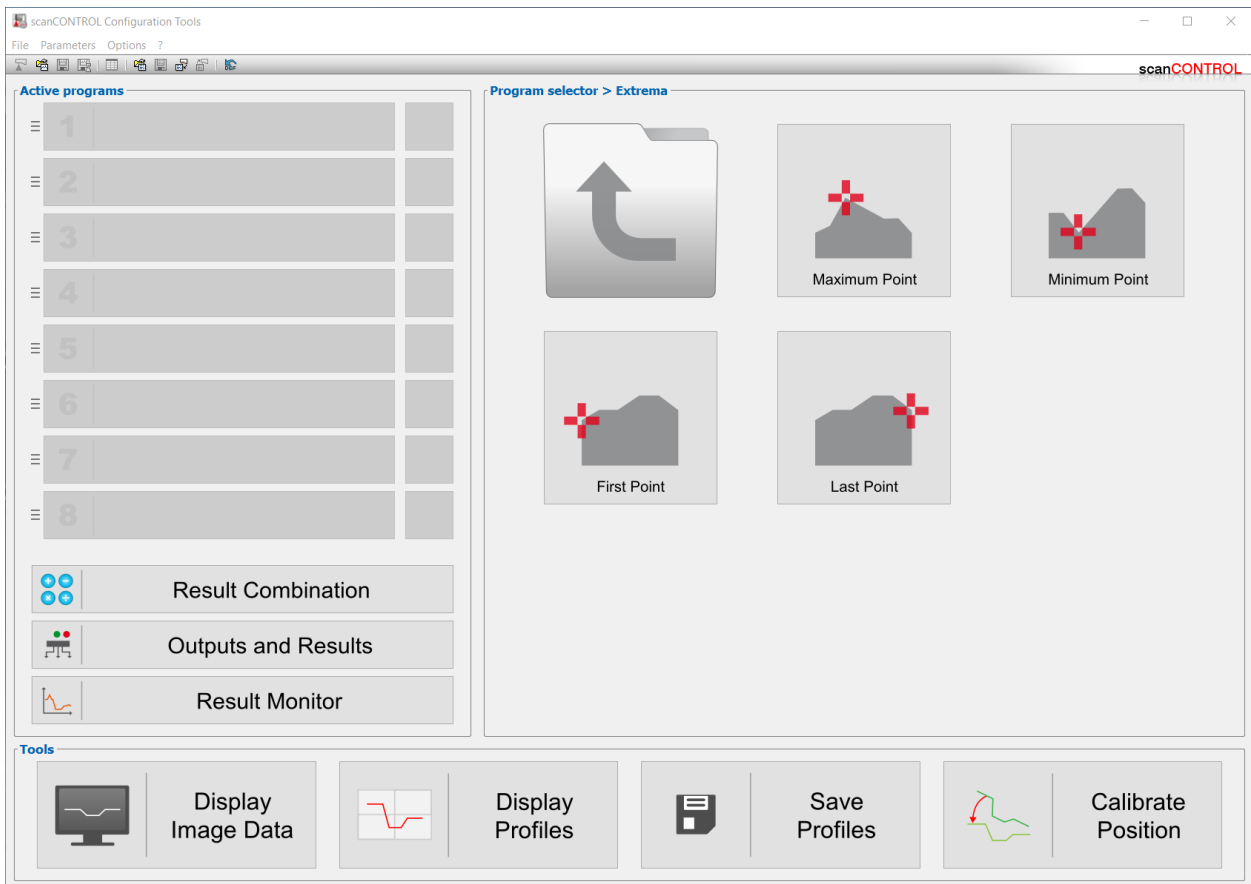


Fig. 4.1: "Extrema" group

Measuring programs in the "Extrema" group:

- Maximum Point: Determination of the point with maximum Z coordinate.
- Minimum Point: Determination of the point with minimum Z coordinate.
- First Point: Determination of the point with minimum X coordinate.
- Last Point: Determination of the point with maximum X coordinate.

4.1.1 "Maximum Point" Measuring Program

Use the "Maximum Point" measuring program to determine the maximum point of a profile. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Maximum X [mm]:** The X coordinate of the maximum point of the currently transferred profile.
- **Maximum Z [mm]:** The Z coordinate of the maximum point of the currently transferred profile.

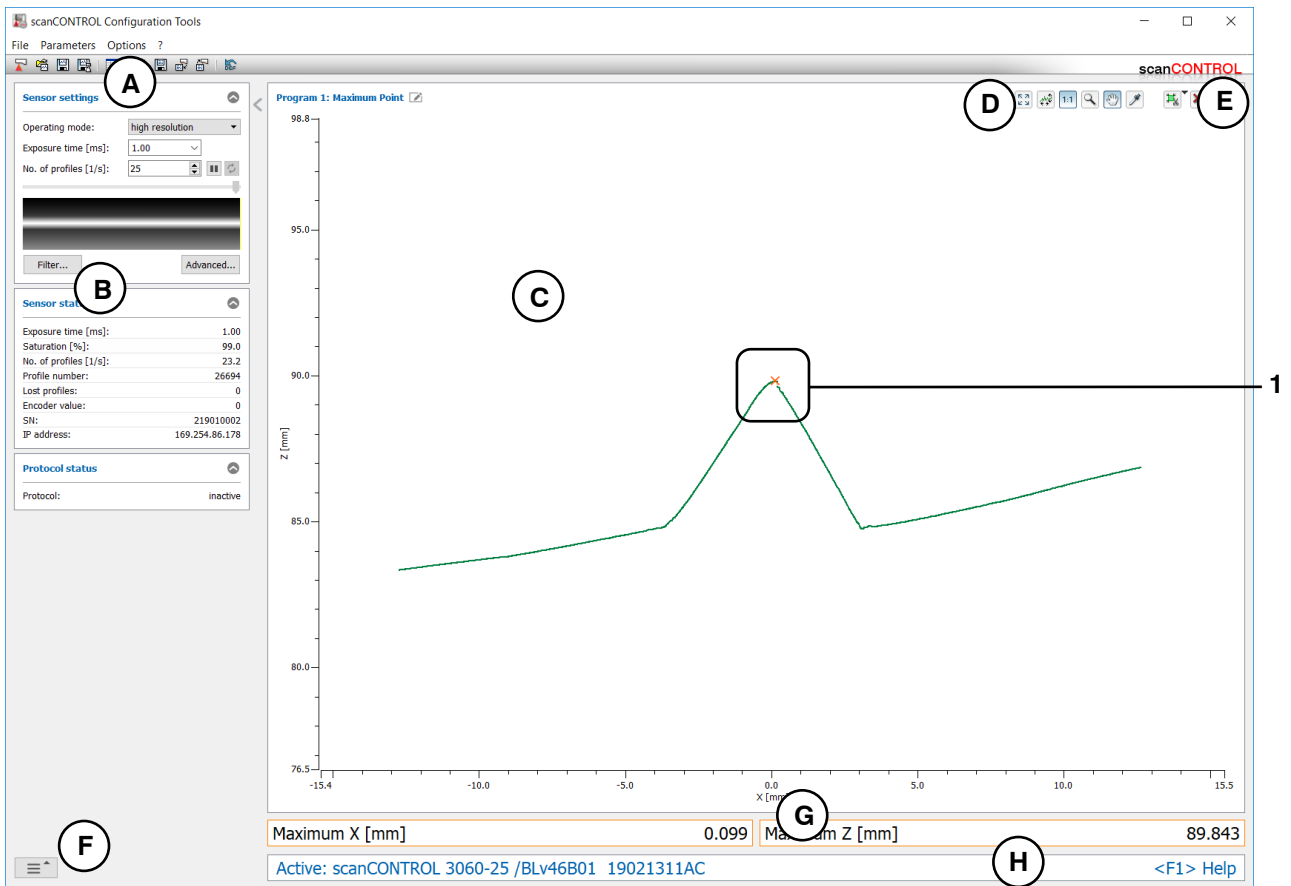


Fig. 4.2: "Maximum Point" measuring program

Display elements and parameters in the "Maximum Point" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Display of the maximum point:** In the 2D-display, the maximum point determined by the measuring program is represented by an orange cross.

4.1.2 "Minimum Point" Measuring Program

Use the "Minimum Point" measuring program to determine the lowest point of a profile. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Minimum X [mm]:** The X coordinate of the minimum point of the currently transferred profile.
- **Minimum Z [mm]:** The Z coordinate of the minimum point of the currently transferred profile.

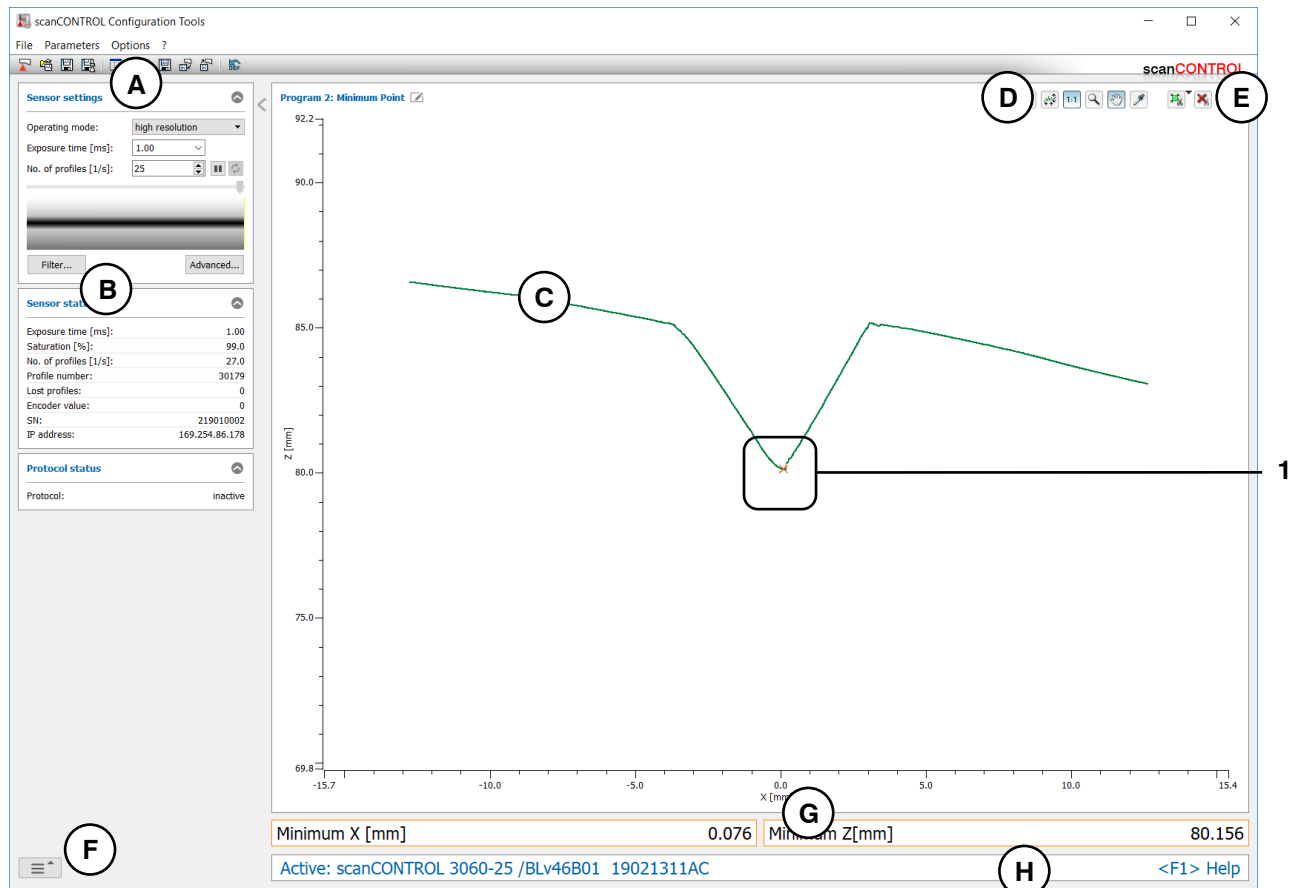


Fig. 4.3: "Minimum Point" measuring program

Display elements and parameters in the "Minimum Point" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Display of the minimum point:** In the 2D-display, the minimum point determined by the measuring program is represented by an orange cross.

4.1.3 "First Point" Measuring Program

Use the "First Point" measuring program to determine the first point (left) of a profile. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **First point X [mm]:** The X coordinate of the first point of the currently transferred profile.
- **First point Z [mm]:** The Z coordinate of the first point of the currently transferred profile.

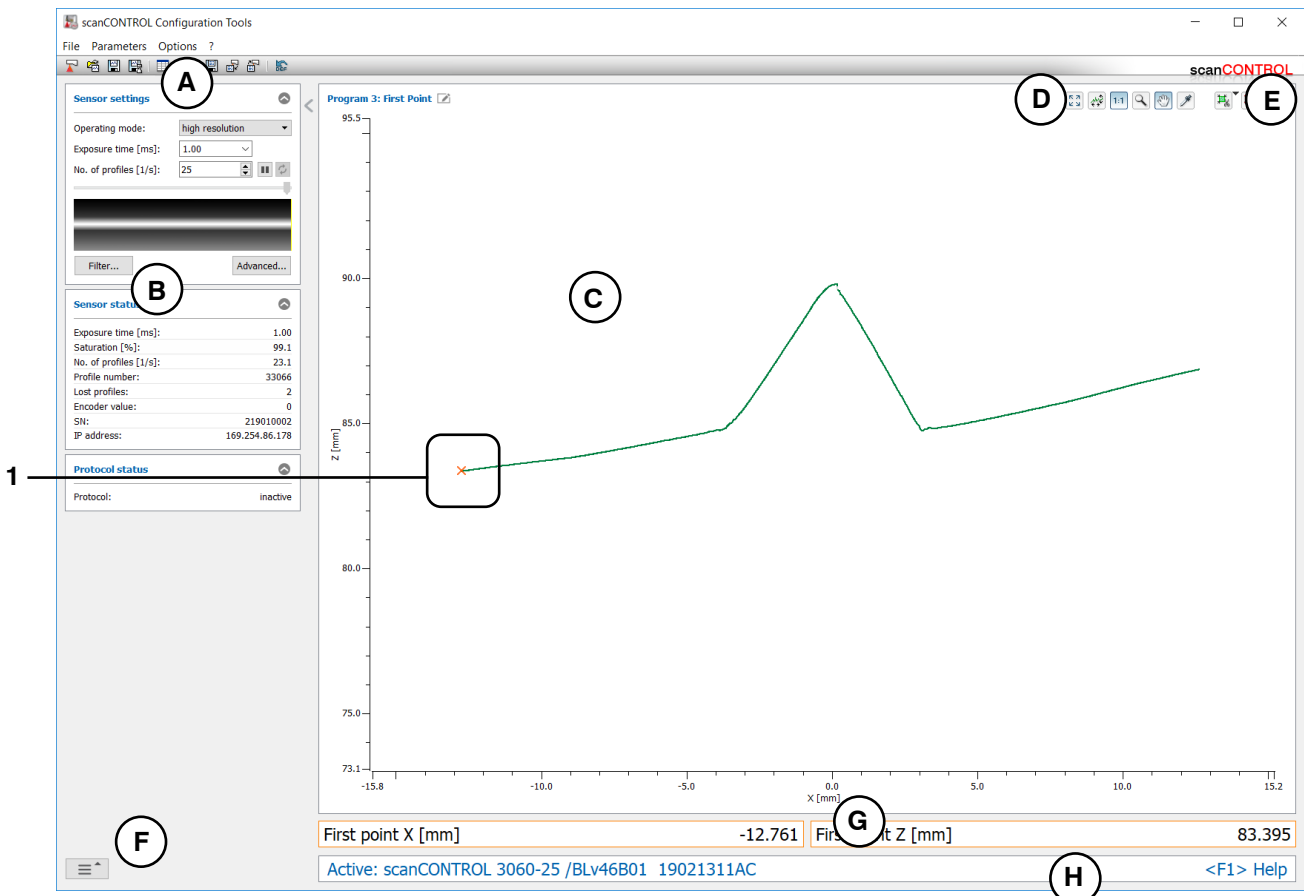


Fig. 4.4: "First Point" measuring program

Display elements and parameters in the "First Point" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** **Display of the first point:** In the 2D-display, the first point determined by the measuring program is represented by an orange cross.

4.1.4 "Last Point" Measuring Program

Use the "Last Point" measuring program to determine the last point (right) of a profile. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Last point X [mm]:** The X coordinate of the last point of the currently transferred profile.
- **Last point Z [mm]:** The Z coordinate of the last point of the currently transferred profile.

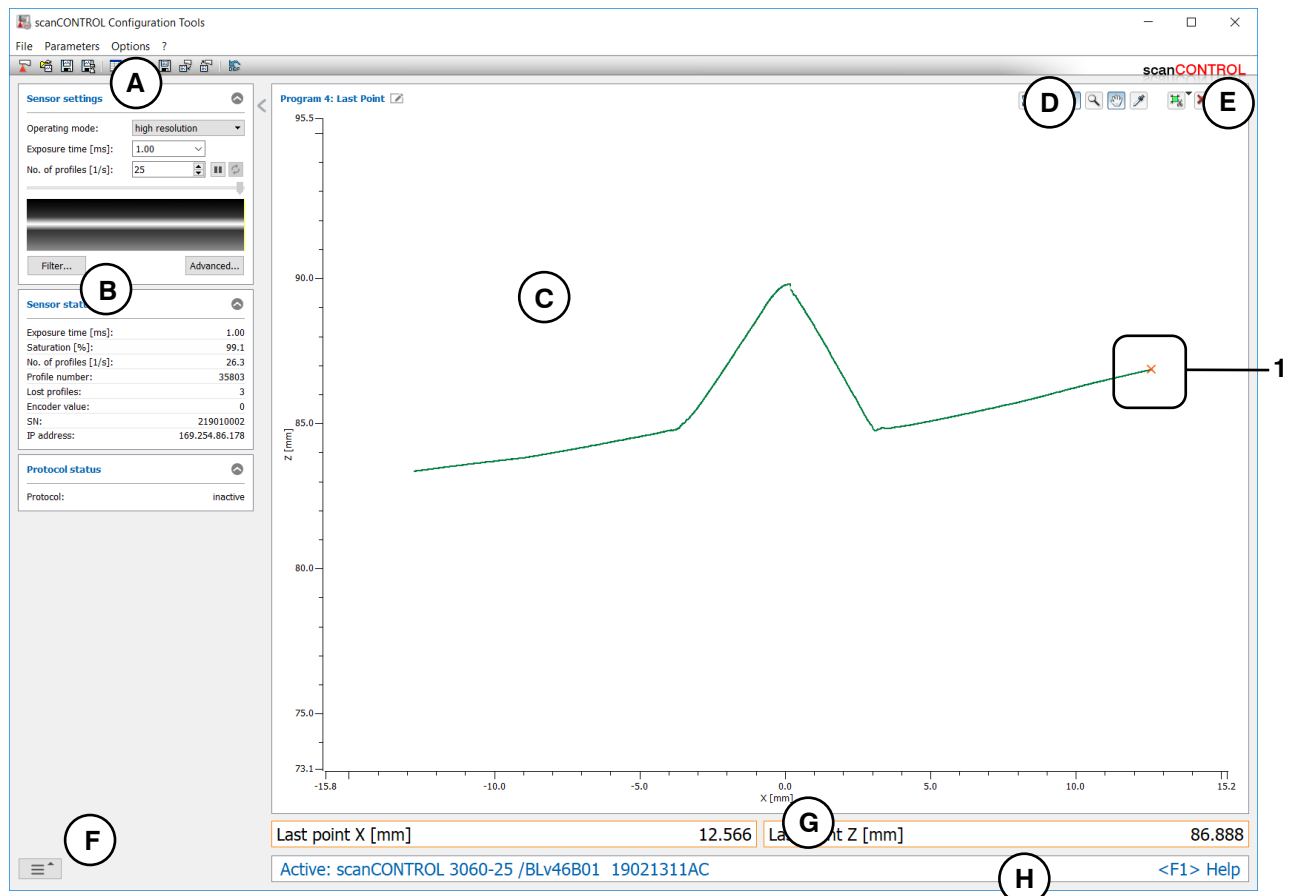


Fig. 4.5: "Last Point" measuring program

Display elements and parameters in the "Last Point" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Display of the last point:** In the 2D-display, the last point determined by the measuring program is represented by an orange cross.

4.2 "Angle" Group

Programs for angle measurement can be found in the "Angle" group.

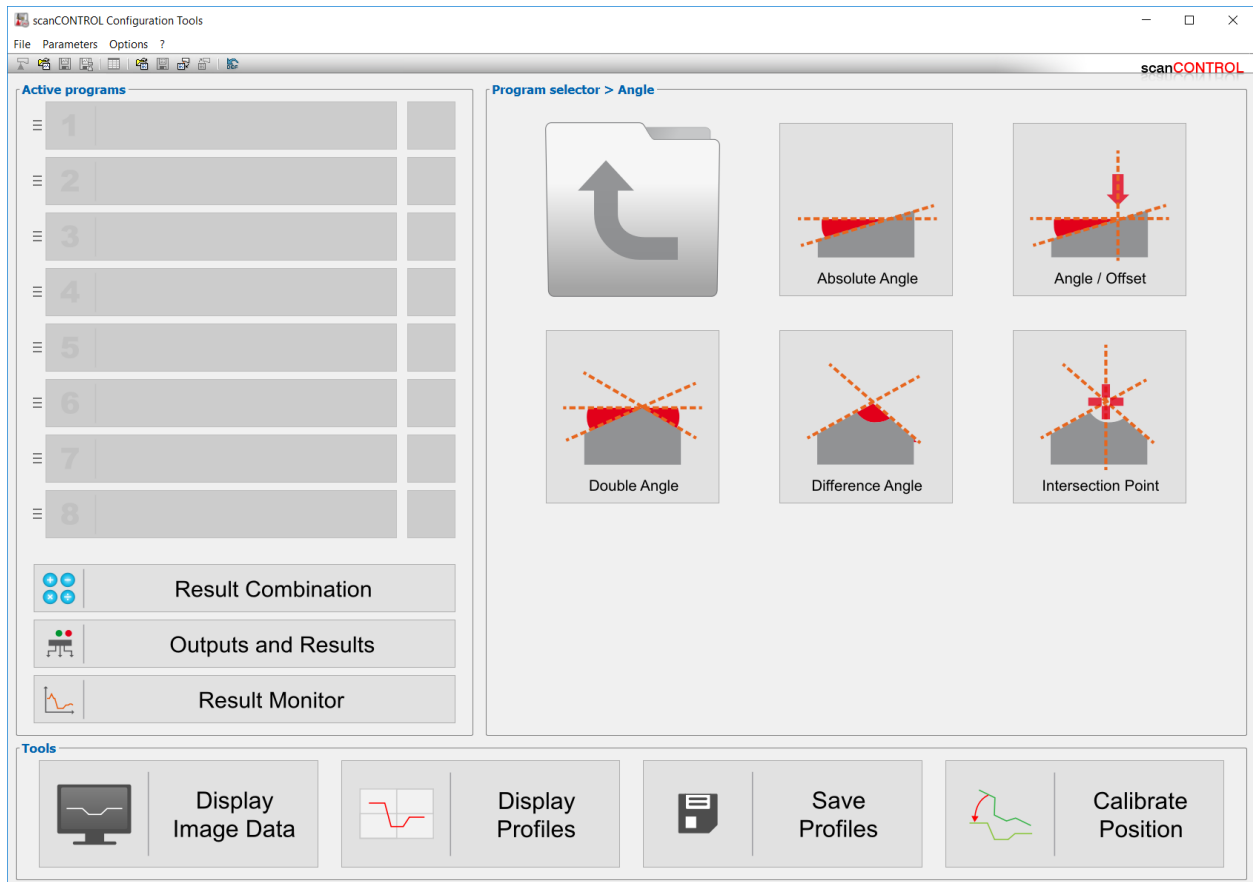








Fig. 4.6: "Angle" group

Measuring programs in the "Angle" group:

- Absolute Angle: Determination of the angle of a straight line to the X axis.
- Angle / Offset: Determination of a straight line and calculation of the offset and the angle to the X axis.
- Double Angle: Determination of two independent straight lines and calculation of the respective angle to the X axis.
- Difference Angle: Determination of two independent straight lines and calculation of the angle between the two lines.
- Intersection Point: Determination of two independent straight lines and calculation of the coordinates of the intersection point between both lines.

4.2.1 "Absolute Angle" Measuring Program

Use the "Absolute Angle" measuring program to determine the angle of a straight line to the X axis. The program determines the best fitting line to the profile points in an adjustable range and measures the angle of this line to the X axis. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Select the type of line fitting (see Fig. 4.7 and Chapter 3.13.1):
 - One range is used for the determination of the fitting line. The line is fitted to the profile points located in the adjustable range .
 - Two ranges are used for the determination of the fitting line. The line is fitted to the profile points located in at least one of the two adjustable ranges .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range or the ranges in which the line should be fitted to the profile points (  see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Angle [°]:** The measured angle between the fitted line and the X axis.

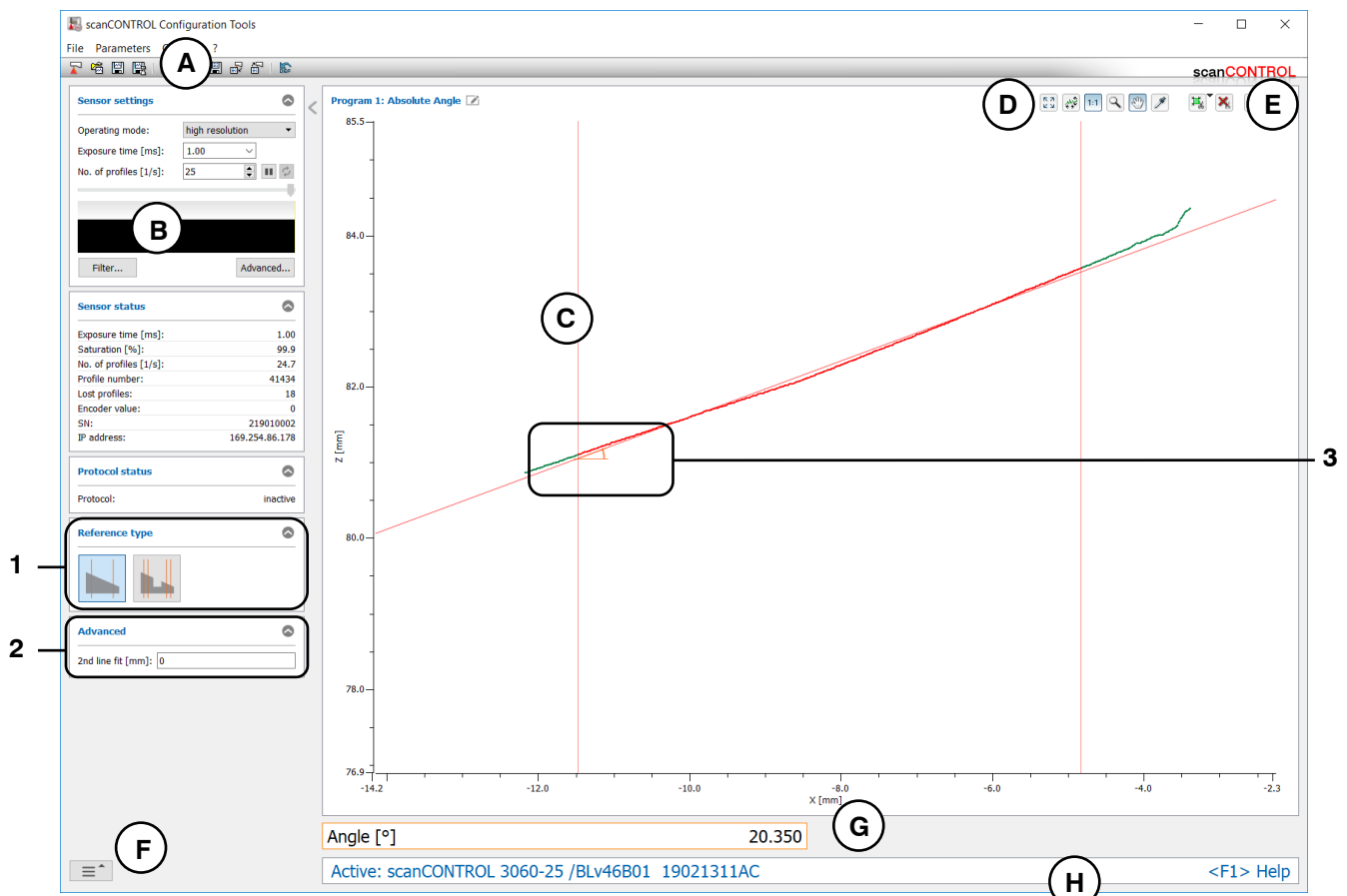









Fig. 4.7: "Absolute Angle" measuring program

Display elements and parameters in the "Absolute Angle" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference type:** Select the type of line fitting in this input field (one range or two ranges).
 - 2 Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 3 Display of the angle:** In the 2D-display, the angle determined by the measuring program is represented by an orange arc.

4.2.2 "Absolute Angle/Offset" Measuring Program

Use the "Absolute Angle/Offset" measuring program to determine the 2D position of a straight line. The program determines the best fitting line to the profile points in an adjustable range and measures the angle and offset of this line. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the algorithm for the calculation of the offset (see Fig. 4.8, Chapter 4.3.1 and Chapter 3.13.1):
 - The Z coordinate of the barycenter of the points located in the fitting area is calculated .
 - The Z coordinate of the intersection point of the fitted line with the Z axis is calculated .
- Select the type of line fitting (see Fig. 4.8 and Chapter 3.13.1)
 - One range is used for the determination of the fitting line. The line is fitted to the profile points located in the adjustable range .
 - Two ranges are used for the determination of the fitting line. The line is fitted to the profile points located in at least one of the two adjustable ranges .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range or the ranges in which the line should be fitted to the profile points ( see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Angle [°]:** The angle between the fitted line and the X axis.
- **Offset [mm]:** The offset of the fitted line.

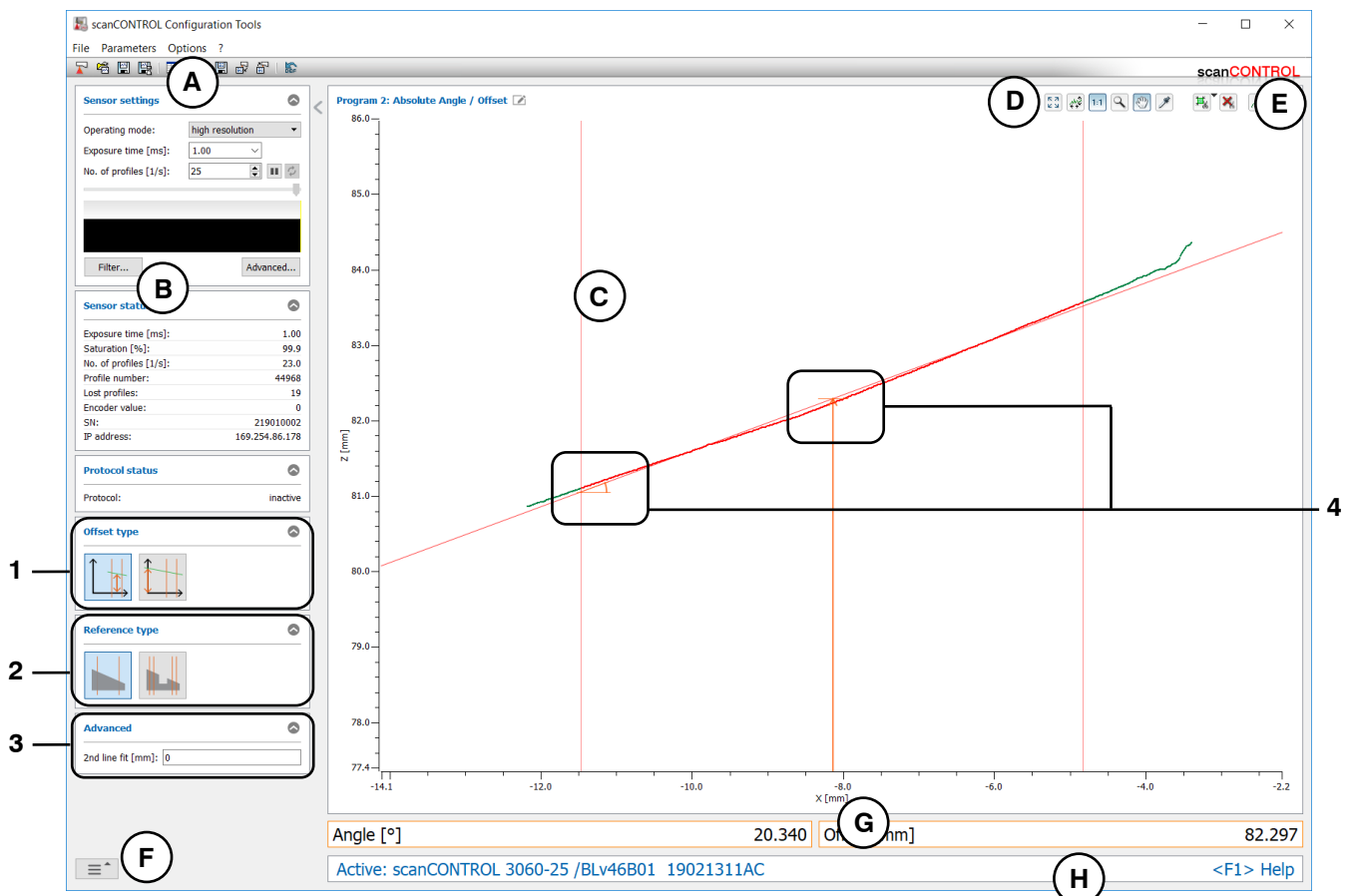


Fig. 4.8: "Absolute Angle/Offset" measuring program

Display elements and parameters in the "Absolute Angle/Offset" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Offset type:** Select the algorithm for the calculation of the offset in this input field (see Chapter 4.3.1).
 - 2 Reference type:** Select the type of line fitting in this input field (one range or two ranges).
 - 3 Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 4 Display of the angle and offset:** In the 2D-display, the angle determined by the measuring program is represented by an orange arc. The offset is displayed using an orange arrow.

4.2.3 "Double Angle" Measuring Program

Use the "Double Angle" measuring program to determine the angle of two straight lines to the X axis. The program determines the best fitting line to the profile points in two adjustable ranges and measures the angle of this line to the X axis in each case. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Left Angle [°]:** The angle between the left fitted line and the X axis.
- **Right Angle [°]:** The angle between the right fitted line and the X axis.

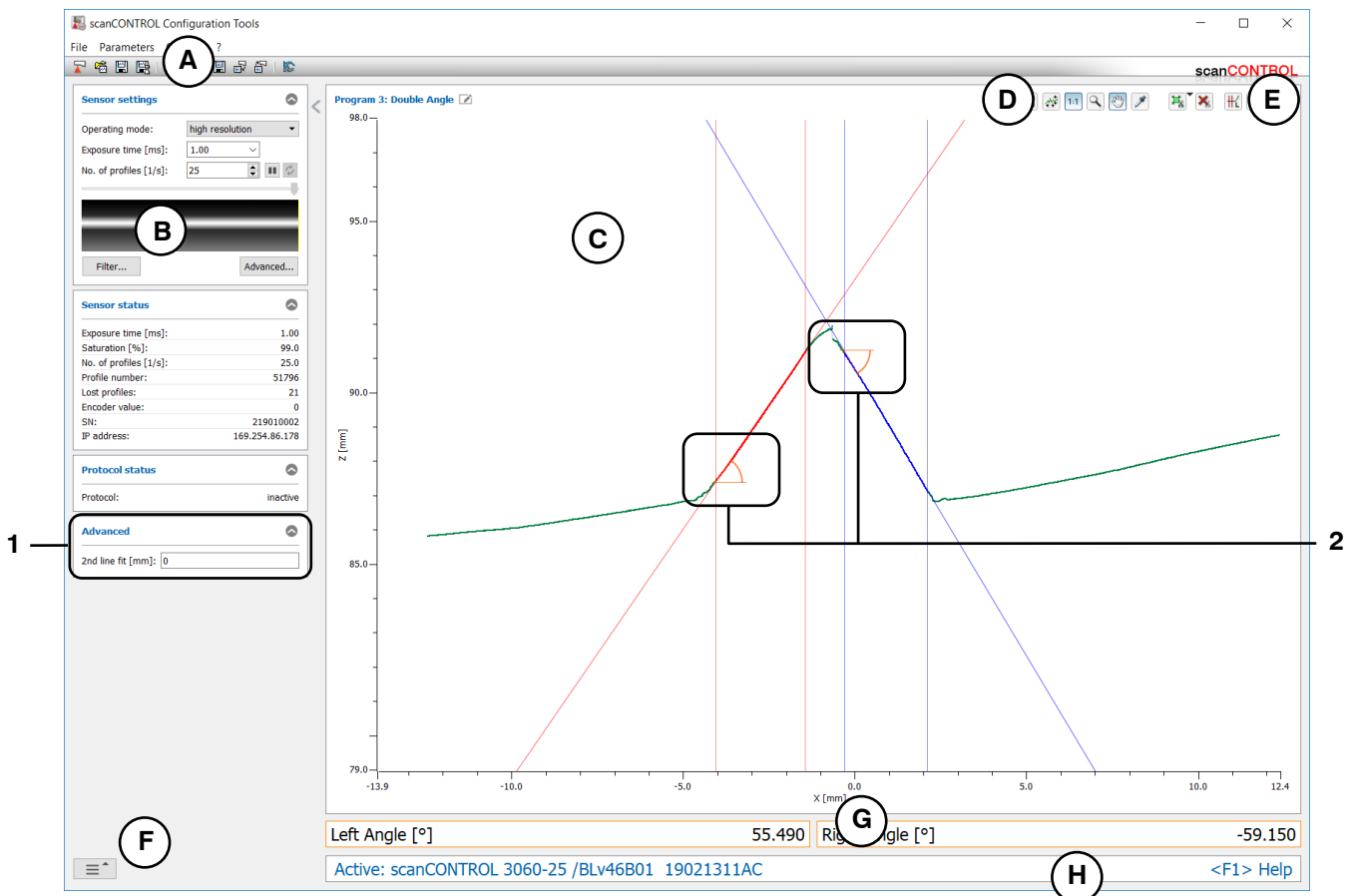


Fig. 4.9: "Double Angle" measuring program







Display elements and parameters in the "Double Angle" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the angles:** In the 2D-display, the angles determined by the measuring program are represented by orange arcs.

4.2.4 "Difference Angle" Measuring Program

Use the "Difference Angle" measuring program to determine the angle between two straight lines. The program determines the best fitting line to the profile points in two adjustable ranges and measures the angle between the two lines. During the configuration of the measurement, you have the possibility to configure the measurement manually or automatically:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define how the angle between both lines is calculated (angle between left and right range  or angle between right and left range , see Fig. 4.10 and Chapter 3.13.1).
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (  see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Angle [°]:** The angle between the two fitted lines.

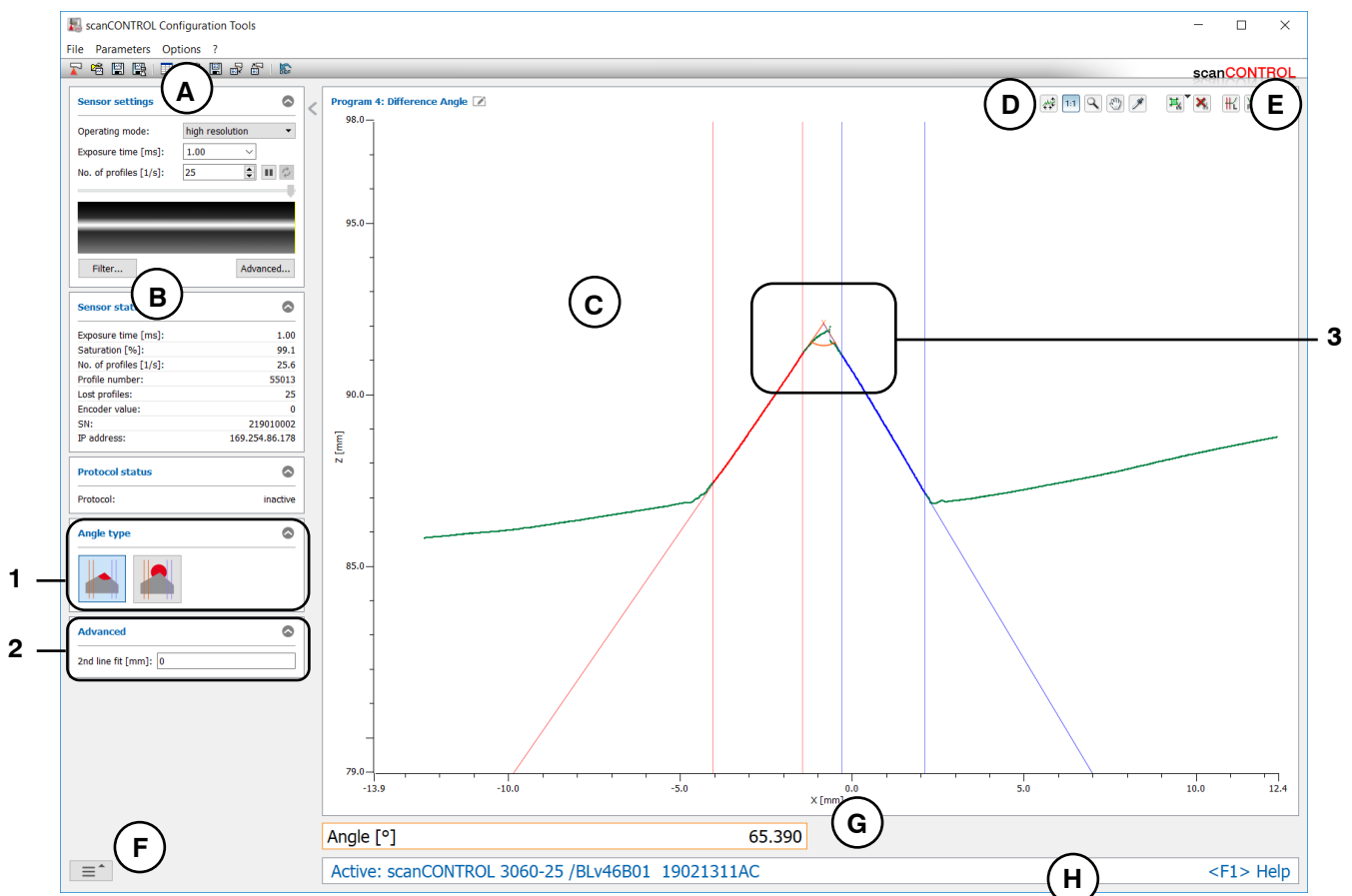


Fig. 4.10: "Difference Angle" measuring program

Display elements and parameters in the "Difference Angle" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Angle type:** Select the angle type in this input field (angle between left and right range or angle between right and left range).
 - 2 Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 3 Display of the angle:** In the 2D-display, the angle determined by the measuring program is represented by an orange arc.

4.2.5 "Intersection Point" Measuring Program

Use the "Intersection Point" measuring program to determine the intersection point between two straight lines. The program determines the best fitting line to the profile points in two adjustable ranges and calculates the coordinates of the intersection point. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Intersection X [mm]:** The X coordinate of the intersection point between the two lines.
- **Intersection Z [mm]:** The Z coordinate of the intersection point between the two lines.

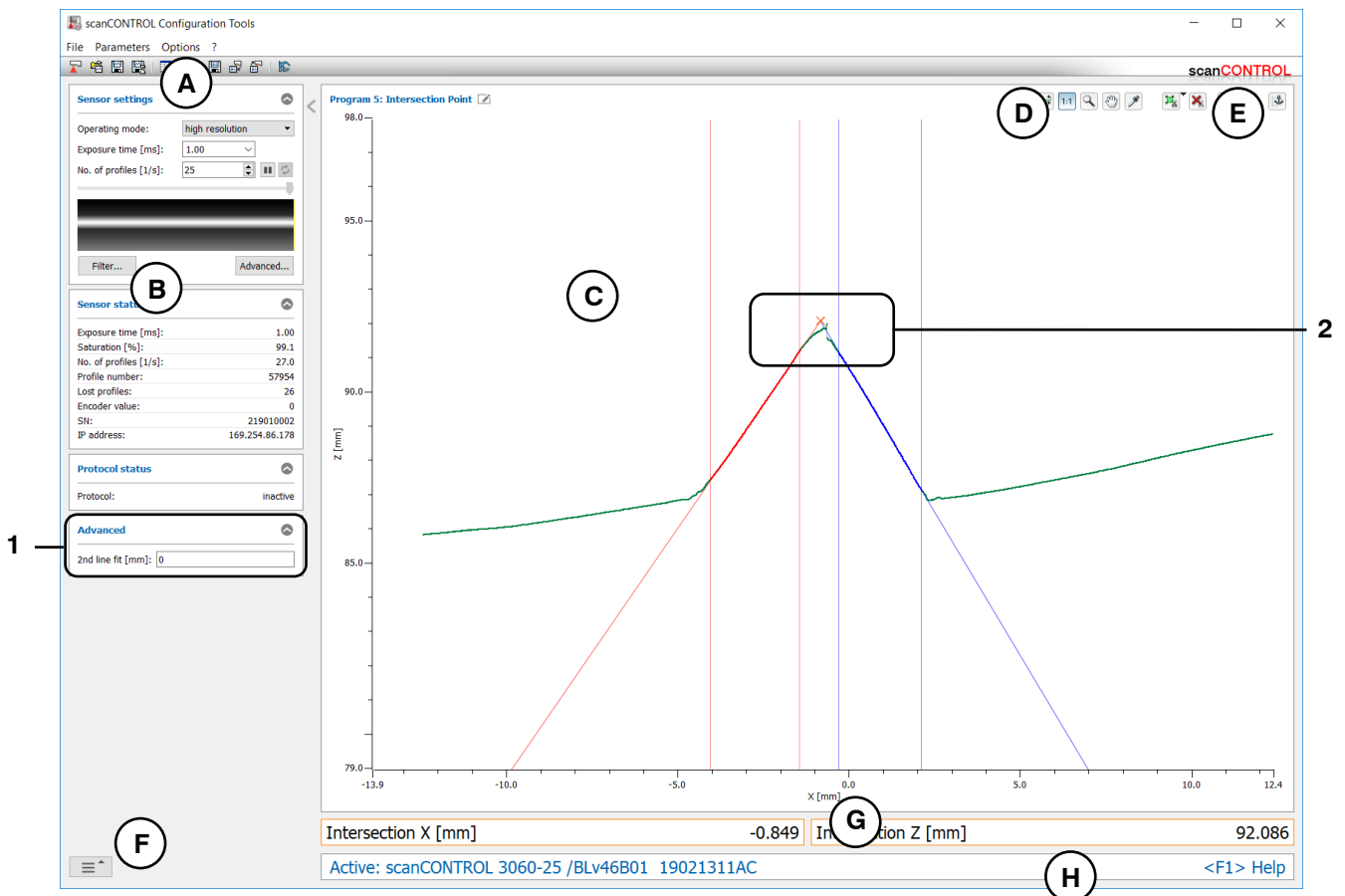


Fig. 4.11: "Intersection Point" measuring program

Display elements and parameters in the "Intersection Point" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the intersection point:** In the 2D-display, the intersection point determined by the measuring program is represented by an orange cross.

4.3 "Edge/Step" Group

Programs for edge and step measurement can be found in the "Edge/Step" group.

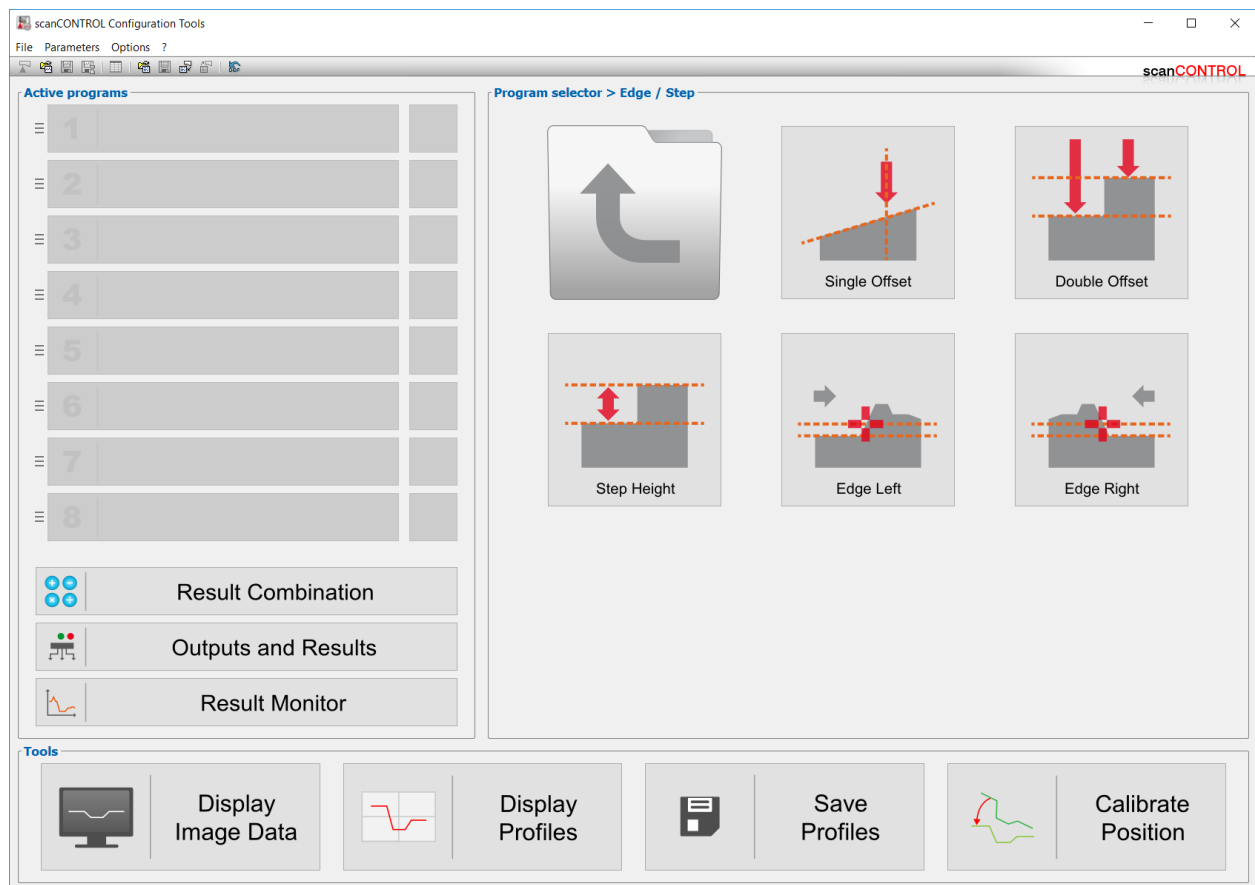









Fig. 4.12: "Edge/Step" group

Measuring programs in the "Edge/Step" group:

- Single Offset: Determination of a straight line and calculation of the offset of the line.
- Double Offset: Determination of two independent straight lines and calculation of the offsets of the lines.
- Step Height: Determination of the height of a step.
- Edge Left: Determination of the position of a rising or falling edge with an edge orientation from left to right.
- Edge Right: Determination of the position of a rising or falling edge with an edge orientation from right to left.

4.3.1 "Single Offset" Measuring Program

Use the "Single Offset" measuring program to determine the offset of a straight line. The program determines the best fitting line to the profile points in an adjustable range and determines the offset of the line. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the algorithm for the calculation of the offset (see Fig. 4.13, Fig. 4.14 and Chapter 3.13.1):
 - The Z coordinate of the barycenter of the points located in the fitting area is calculated .
 - The Z coordinate of the intersection point of the fitted line with the Z axis is calculated .
- Select the type of line fitting (see Fig. 4.14 and Chapter 3.13.1)
 - One range is used for the determination of the fitting line. The line is fitted to the profile points located in the adjustable range .
 - Two ranges are used for the determination of the fitting line. The line is fitted to the profile points located in at least one of the two adjustable ranges .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range or the ranges in which the line should be fitted to the profile points ( see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively ( see Chapter 3.13.6).

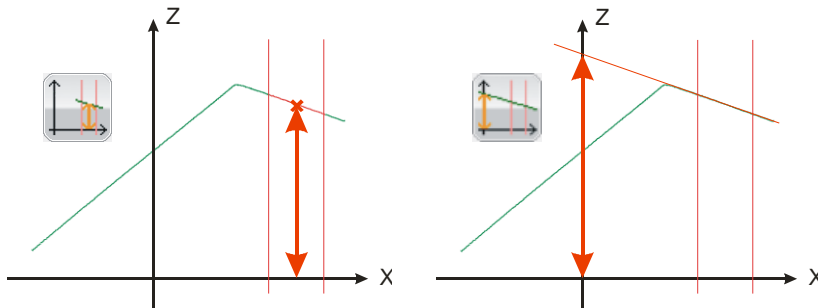


Fig. 4.13: Algorithms for the offset calculation

The measuring program outputs the following measured value:

- **Offset [mm]:** The offset of the fitted line.

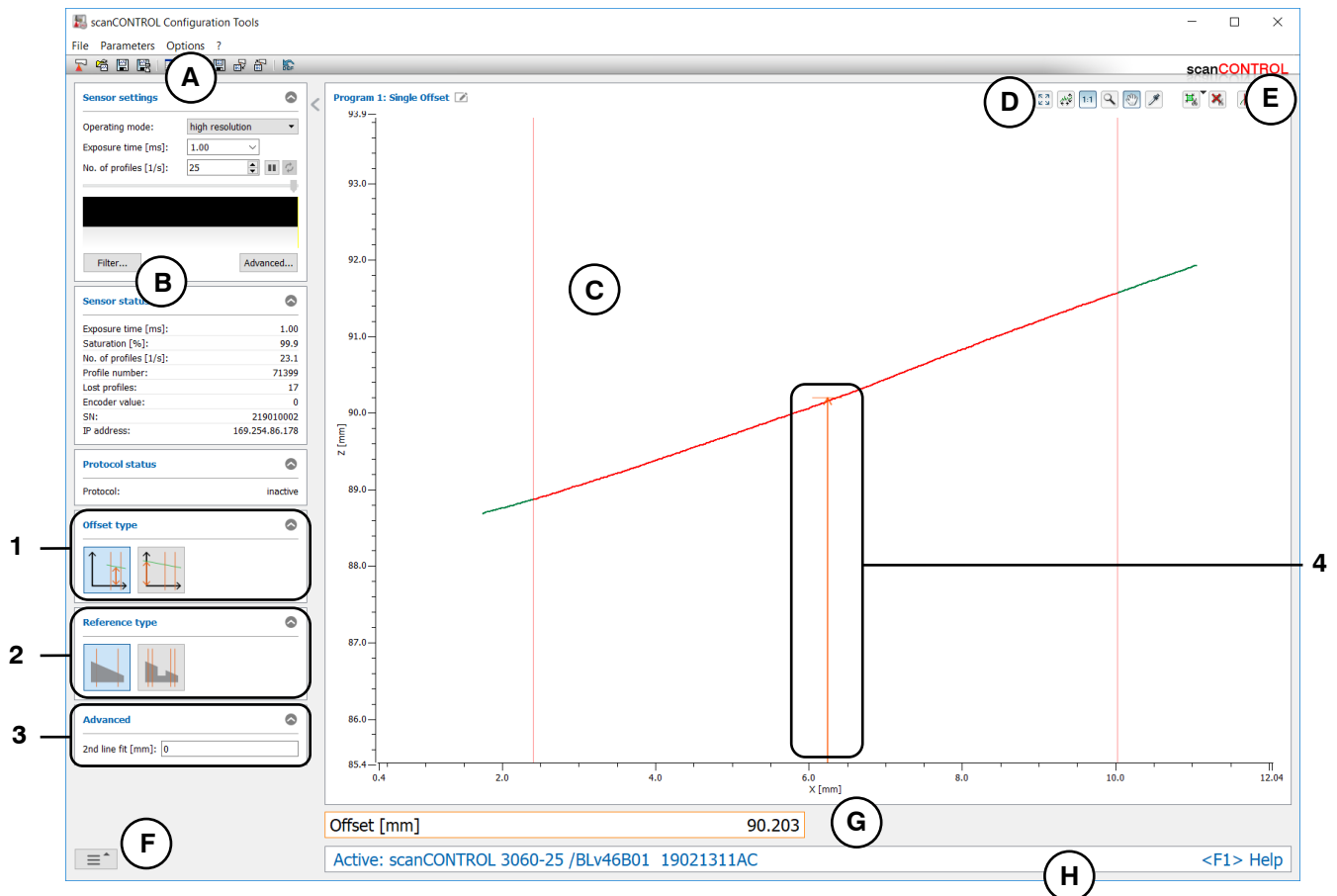


Fig. 4.14: "Single Offset" measuring program









Display elements and parameters in the "Single Offset" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G Results display:** The results of the current valid measurement are displayed.
- H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1 **Offset type:** Select the algorithm for the calculation of the offset in this input field (see Fig. 4.13).
- 2 **Reference type:** Select the type of line fitting in this input field (one range or two ranges).
- 3 Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
- 4 **Display of the offset:** In the 2D-display, the offset determined by the measuring program is represented by an orange arrow.

4.3.2 "Double Offset" Measuring Program

Use the "Double Offset" measuring program to determine the respective offset of two straight lines. The program determines the best fitting line to the profile points in two adjustable ranges and determines the offset of the line in each case. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the algorithm for the calculation of both offsets (see Fig. 4.13, Chapter 4.3.1 and Chapter 3.13.1):
 - The Z coordinate of the barycenter of the points located in the fitting area is calculated .
 - The Z coordinate of the intersection point of the fitted line with the Z axis is calculated .
- Define the type of lines (parallel  or not parallel , see Fig. 4.15 and Chapter 3.13.1). This selection is only available if the algorithm for the calculation of the offset is set to "Z coordinate of the intersection point of the fitted line with the Z axis"
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (  see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Left Offset [mm]:** The offset of the left line.
- **Right Offset [mm]:** The offset of the right line.

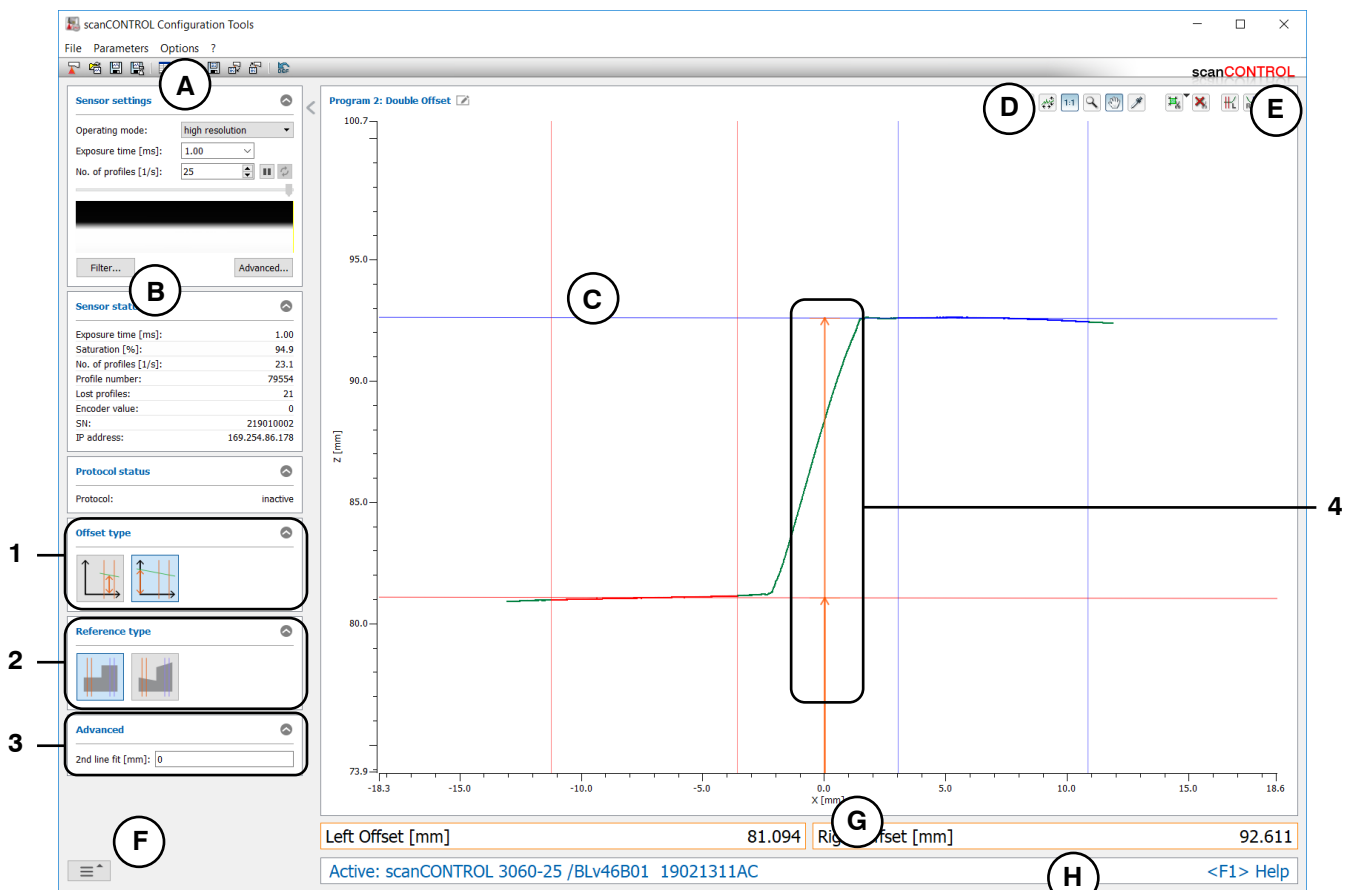









Fig. 4.15: "Double Offset" measuring program

Display elements and parameters in the "Double Offset" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Offset type:** Select the algorithm for the calculation of the offsets in this input field (see Chapter 4.3.1).
 - 2 Reference type:** In this input field, select the type of the two lines ("parallel" or "not parallel").
 - 3 Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 4 Display of the offsets:** In the 2D-display, the offsets determined by the measuring program are represented by orange arrows.

4.3.3 "Step Height" Measuring Program

Use the "Step Height" measuring program to determine the height of a step. The program determines the best fitting line to the profile points in two adjustable ranges where both lines are parallel to each other. The measuring program then determines the difference of the offsets of the lines in Z direction. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the algorithm for the calculation of the height (see Fig. 4.16, Fig. 4.17 and Chapter 3.13.1):
 - The perpendicular distance of the two lines is calculated .
 - Initially the barycenters are calculated in both fitting ranges. The difference between the Z coordinates of the barycenters is used as height .
 - The distance between the two lines in Z axis direction is calculated .
- If necessary, invert the sign of the height (see Fig. 4.17).
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (  see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively ( see Chapter 3.13.6).

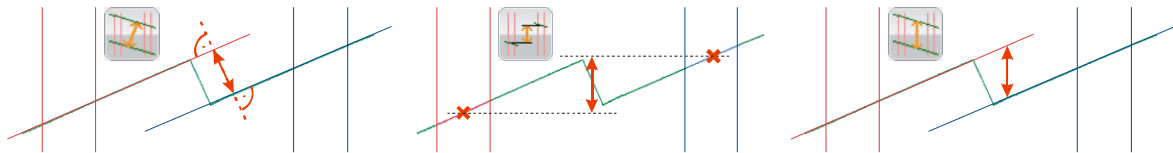


Fig. 4.16: Algorithms for height calculation

The measuring program outputs the following measured value:

- **Height [mm]:** The height calculated according to the selected algorithm.

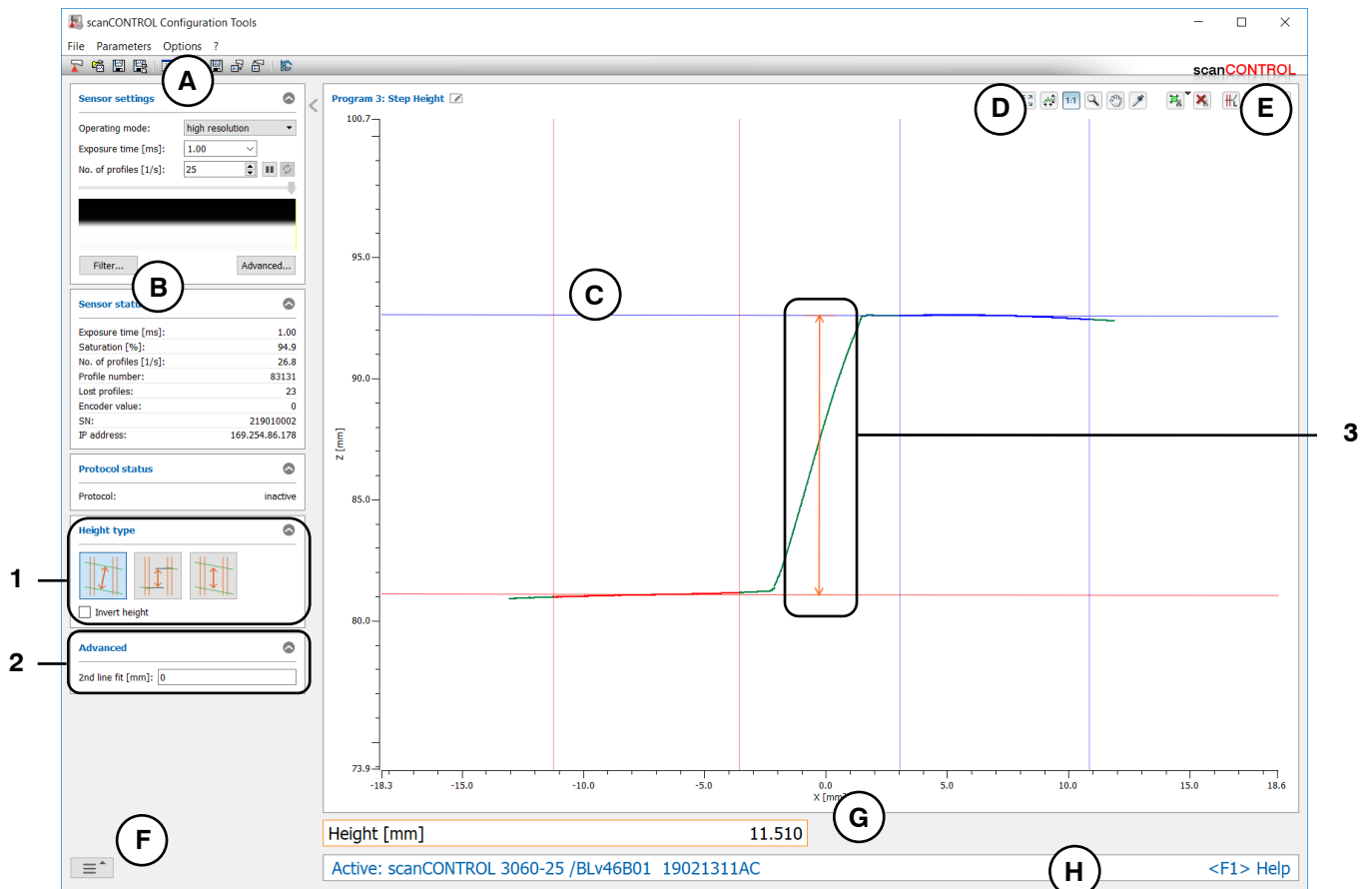













Fig. 4.17: "Step Height" measuring program

Display elements and parameters in the "Step Height" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1** **Height type:** In this input field, select the algorithm for the calculation of the height (see Fig. 4.16) and invert the sign of the height, if necessary.
 - 2** **Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 3** **Display of the height:** In the 2D-display, the height determined by the measuring program is represented by an orange arrow.

4.3.4 "Edge Left" Measuring Program

Use the "Edge Left" measuring program to determine the position of an edge. Thereby, the program determines an edge which runs from left to right. The possible position of the edge is limited by two fitting ranges and must be between these ranges. The program determines the best fitting line to the profile points in each of the fitting ranges. A threshold relative to the left fitting line is specified and thus a parallel intersecting line is produced. If the intersecting line intersects the profile, an edge is detected and the measuring program determines the coordinates of the edge. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of edge (see Fig. 4.18 and Chapter 3.13.1):
 - The edge is rising and located between two reference ranges which are parallel .
 - The edge is rising. The range for the fitting line is located left of the edge .
 - The edge is falling and located between two reference ranges which are parallel .
 - The edge is falling. The range for the fitting line is located left of the edge .
- Define the type of detection (see Fig. 4.18 and Chapter 3.13.1):
 - At least one profile point on the right side of the edge is necessary for edge detection .
 - No point on the right side of the edge is necessary for edge detection .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (  see Chapter 3.13.4).
- Define the position of the intersecting line ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Edge X [mm]:** The X coordinate of the calculated edge.
- **Edge Z [mm]:** The Z coordinate of the calculated edge.

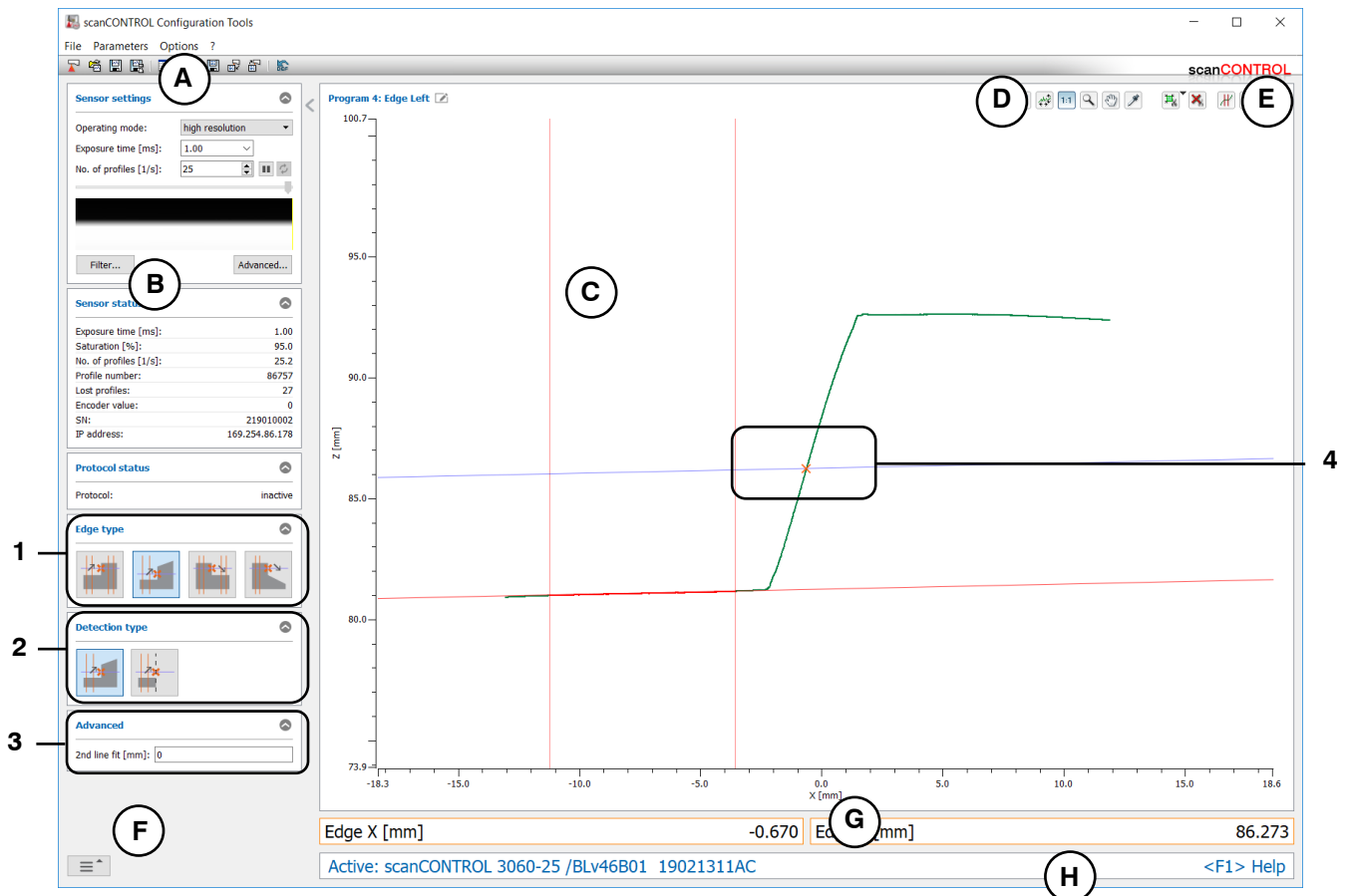













Fig. 4.18: "Edge Left" measuring program

Display elements and parameters in the "Edge Left" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1** **Type of edge:** Select the type of edge (see above) in this input field.
 - 2** **Detection type:** Select the type of detection (see above) in this input field.
 - 3** **Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 4** **Display of the edge position:** In the 2D-display, the edge position determined by the measuring program is represented by an orange cross.

4.3.5 "Edge Right" Measuring Program

Use the "Edge Right" measuring program to determine the position of an edge. Thereby, the program determines an edge which runs from right to left. The possible position of the edge is limited by two fitting ranges and must be between these ranges. The program determines the best fitting line to the profile points in each of the fitting ranges. A threshold relative to the right fitting line is specified and thus a parallel intersecting line is produced. If the intersecting line intersects the profile, an edge is detected and the measuring program determines the coordinates of the edge. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of edge (see Fig. 4.19 and Chapter 3.13.1):
 - The edge is rising and located between two reference ranges which are parallel .
 - The edge is rising. The range for the fitting line is located right of the edge .
 - The edge is falling and located between two reference ranges which are parallel .
 - The edge is falling. The range for the fitting line is located right of the edge .
- Define the type of detection (see Fig. 4.19 and Chapter 3.13.1):
 - At least one profile point on the left side of the edge is necessary for edge detection .
 - No point on the left side of the edge is necessary for edge detection .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (  see Chapter 3.13.4).
- Define the position of the intersecting line ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Edge X [mm]:** The X coordinate of the calculated edge.
- **Edge Z [mm]:** The Z coordinate of the calculated edge.

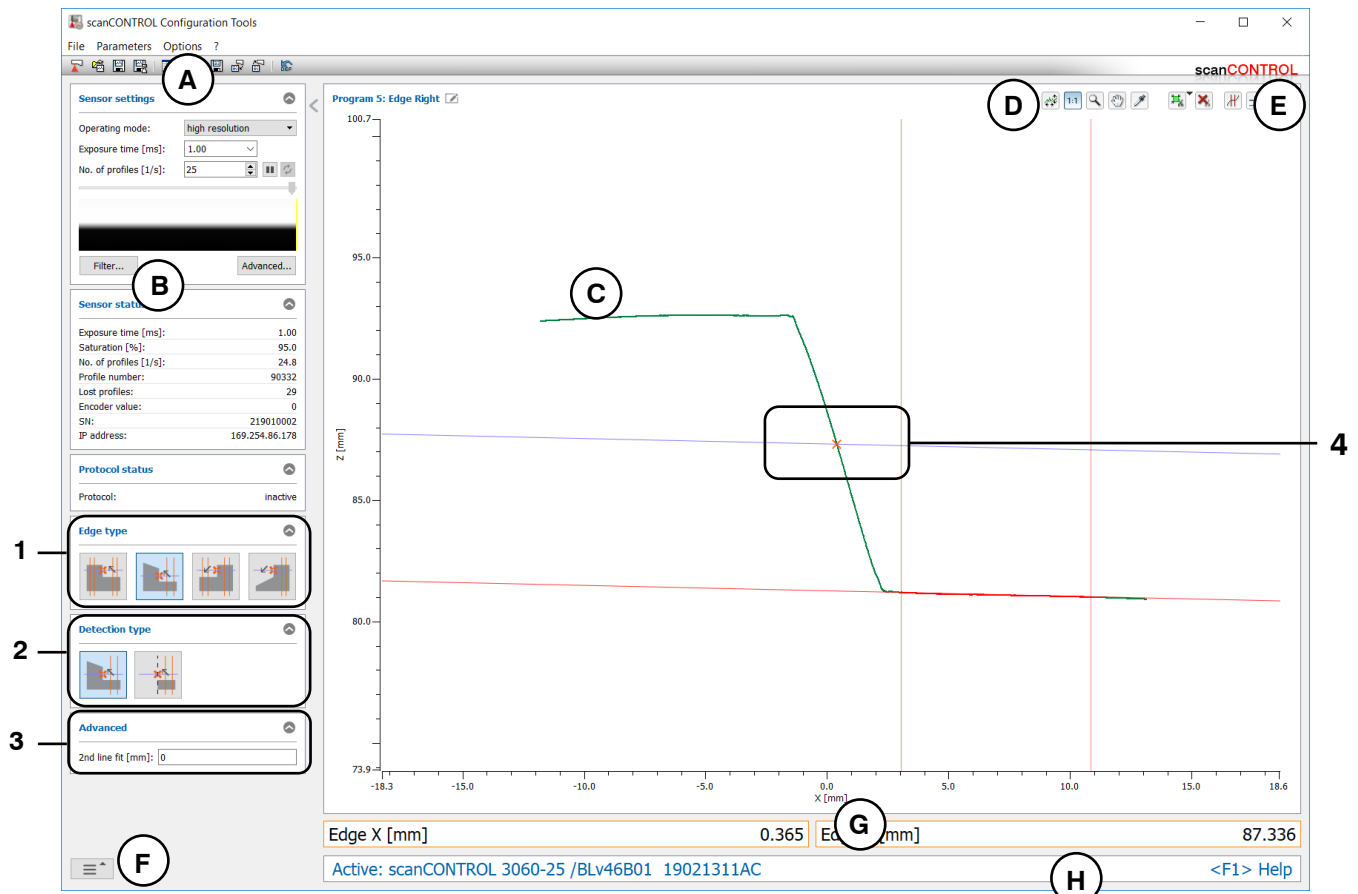


Fig. 4.19: "Edge Right" measuring program

Display elements and parameters in the "Edge Right" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Type of edge:** Select the type of edge (see above) in this input field.
 - 2 Detection type:** Select the type of detection (see above) in this input field.
 - 3 Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 4 Display of the edge position:** In the 2D-display, the edge position determined by the measuring program is represented by an orange cross.

4.4 "Surface" Group

Programs for surface inspection can be found in the "Surface" group.

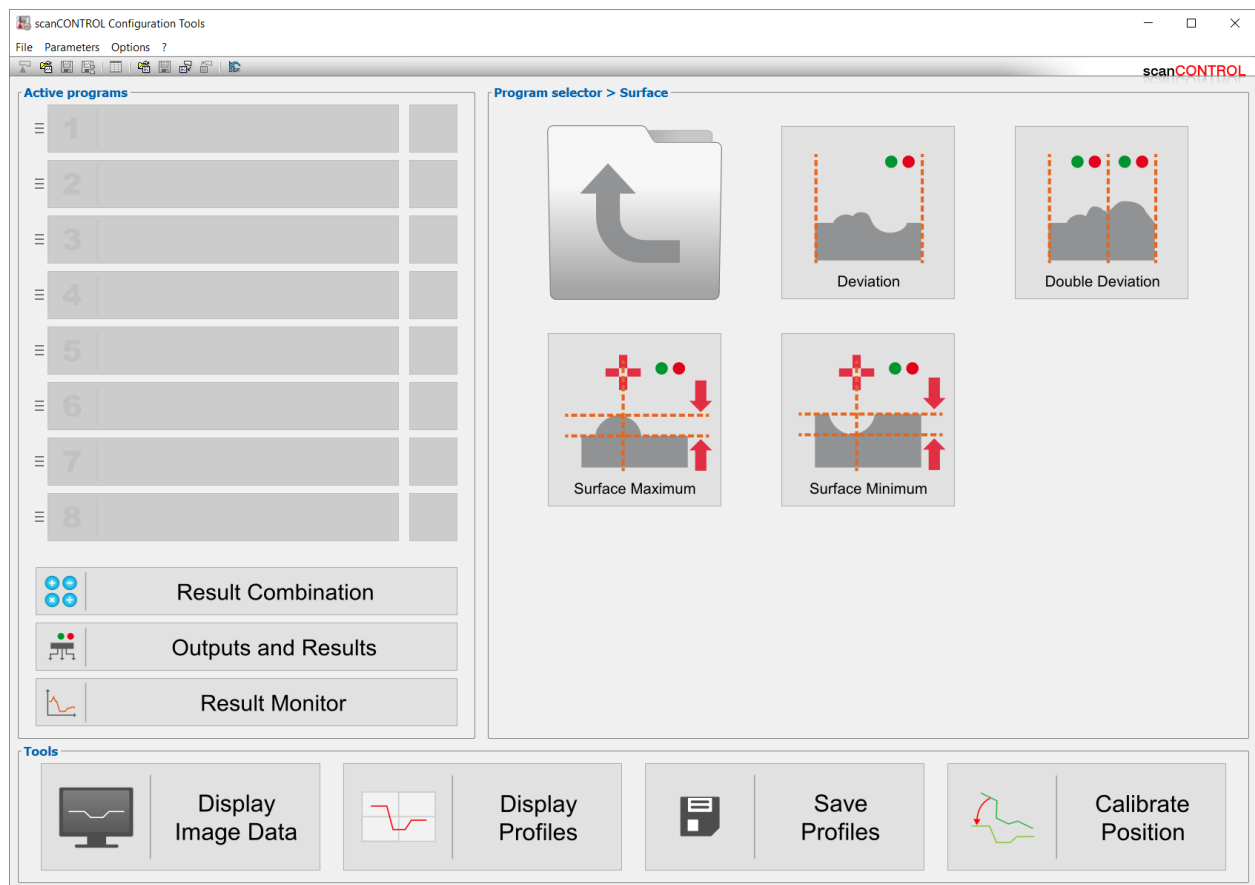


Fig. 4.20: "Surface" group

Measuring programs in the "Surface" group:

- Deviation: Determination of a straight line and calculation of the number of points and the average deviation of the points from the line.
- Double Deviation: Determination of two independent straight lines and calculation of the average deviation of the points from the respective line.
- Surface Maximum: Determination of a straight line and calculation of the distance and the X coordinate of the point with maximum positive distance from the line.
- Surface Minimum: Determination of a straight line and calculation of the distance and the X coordinate of the point with maximum negative distance from the line.

4.4.1 "Deviation" Measuring Program

Use the "Deviation" measuring program to determine the average deviation of points from a straight line. The program determines the best fitting line to the profile points in an adjustable range and calculates the standard deviation of the distances of the points from the line. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the range in which the line should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **No. of points:** The number of profile points in the fitting range.
- **Sigma [mm]:** The standard deviation of the distances of the points in the fitting range from the fitted line.

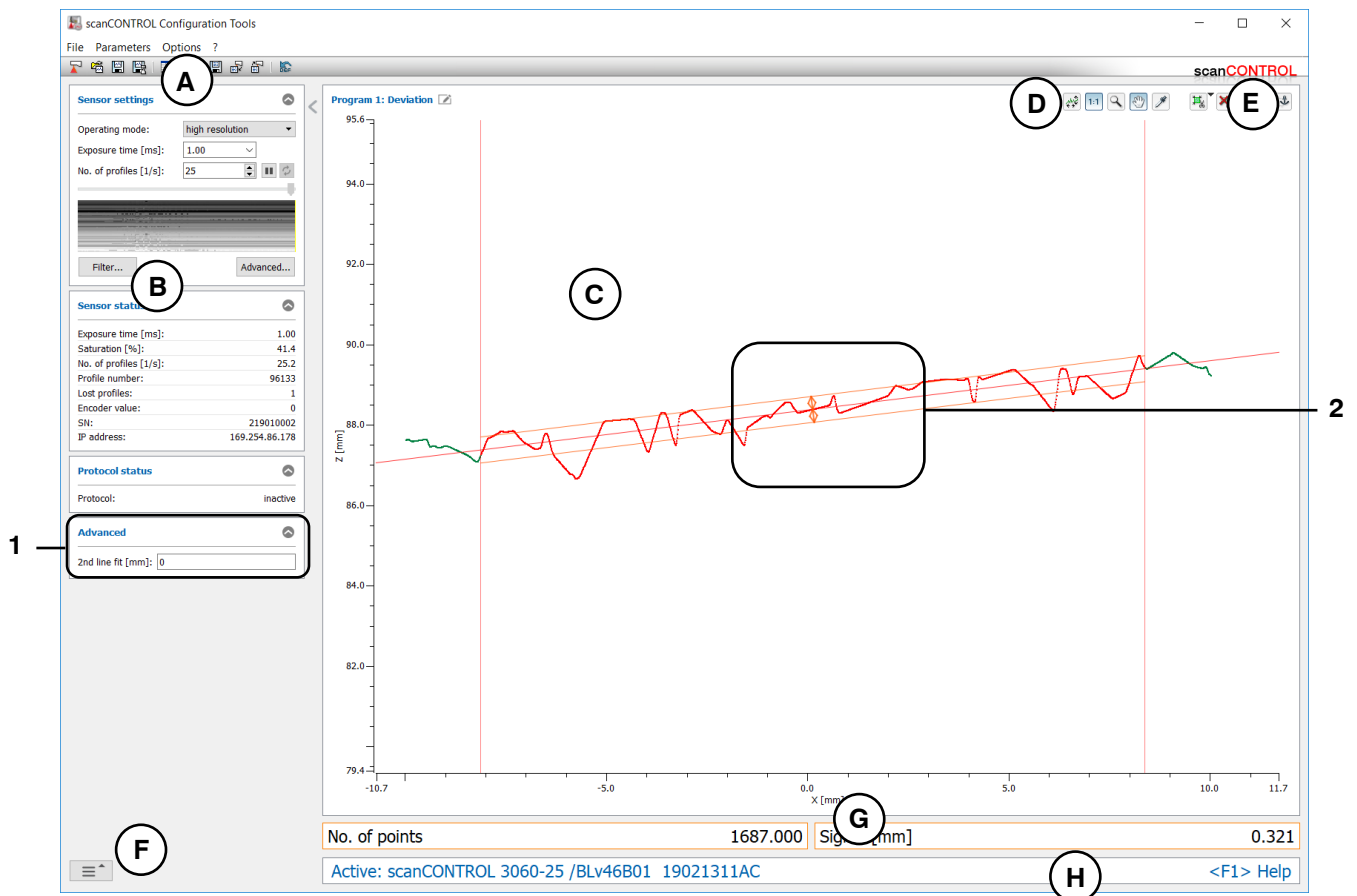


Fig. 4.21: "Deviation" measuring program

Display elements and parameters in the "Deviation" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 2** **Display of the standard deviation:** In the 2D-display, the standard deviation determined by the measuring program is represented by two orange lines and arrows.

4.4.2 "Double Deviation" Measuring Program

Use the "Double Deviation" measuring program to determine the average deviation of points from two straight lines. The program determines the best fitting line to the profile points in two adjustable ranges and calculates the standard deviation of the distances of the points from the associated line in each case. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the ranges in which the lines should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the ranges for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Sigma Left [mm]:** The standard deviation of the distances of the points in the left fitting range from the left line.
- **Sigma Right [mm]:** The standard deviation of the distances of the points in the right fitting range from the right line.

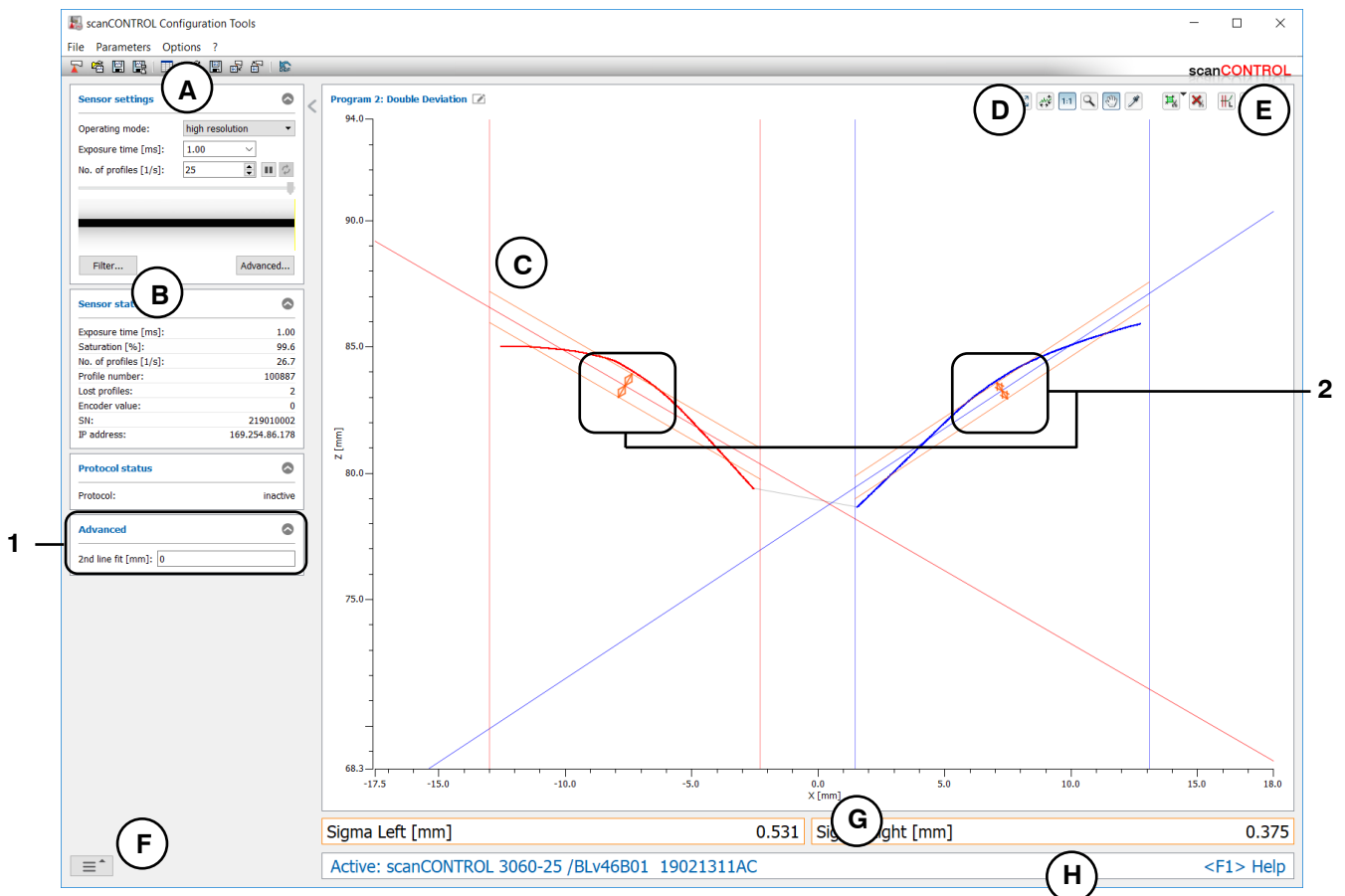


Fig. 4.22: "Double Deviation" measuring program

Display elements and parameters in the "Double Deviation" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the standard deviations:** In the 2D-display, the standard deviations determined by the measuring program are each represented by two orange lines and arrows.

4.4.3 "Surface Maximum" Measuring Program

Use the "Surface Maximum" measuring program to determine the maximum positive deviation of a surface and its position. The program determines the best fitting line to the profile points in an adjustable range and determines the point with maximum positive distance from the line. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the range in which the line should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Position X [mm]:** The X coordinate of the point with maximum positive distance from the line.
- **Height [mm]:** The maximum positive distance from the line.

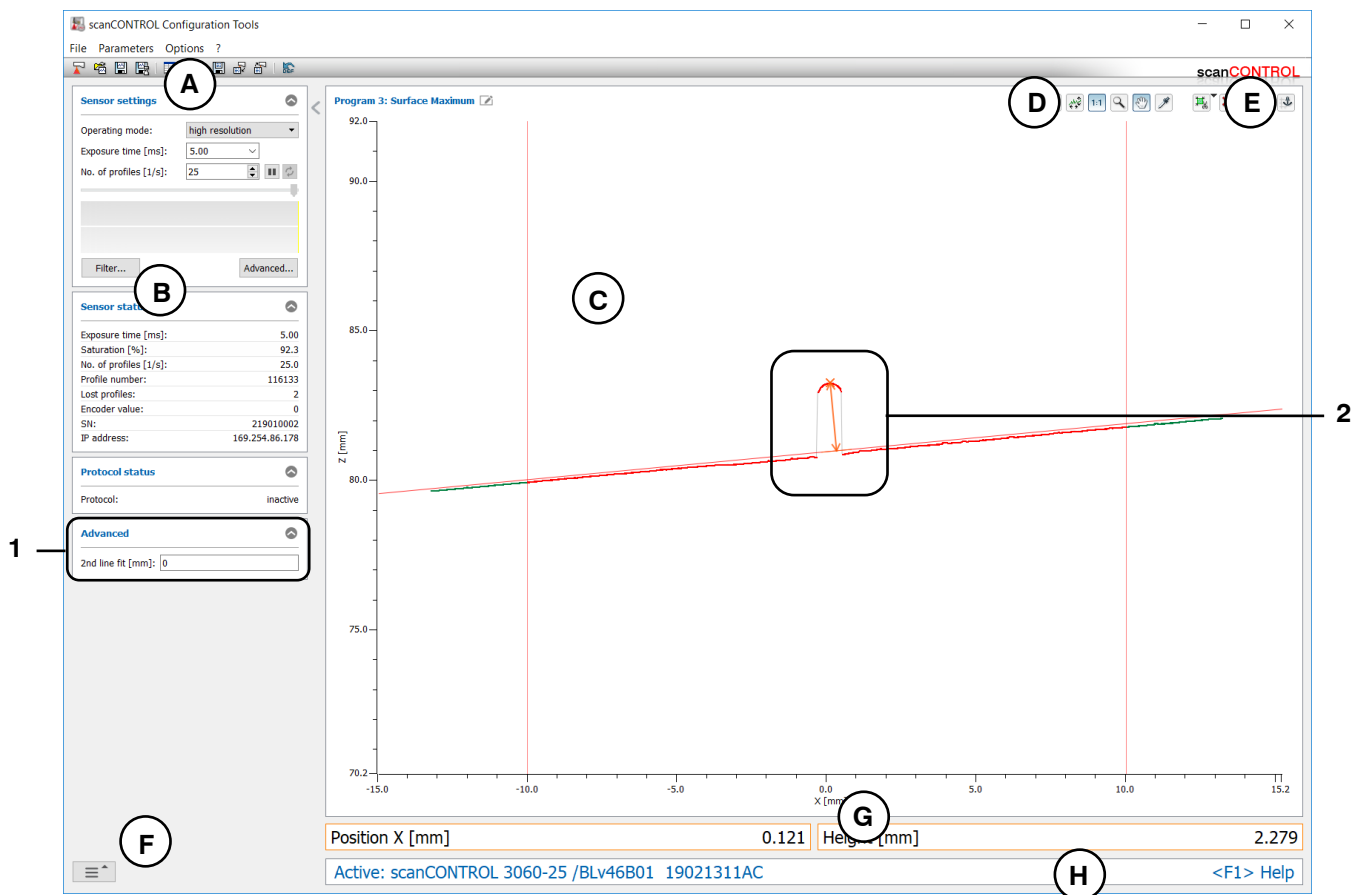


Fig. 4.23: "Surface Maximum" measuring program

Display elements and parameters in the "Surface Maximum" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the results:** In the 2D-display, the point determined by the measuring program is represented by an orange cross. The maximum positive distance is indicated by an arrow.

4.4.4 "Surface Minimum" Measuring Program

Use the "Surface Minimum" measuring program to determine the maximum negative deviation of a surface and its position. The program determines the best fitting line to the profile points in an adjustable range and determines the point with maximum negative distance from the line. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- Define the range in which the line should be fitted to the profile points (see Chapter 3.13.4).
- If necessary, activate the dynamic tracking for the measuring range and for the range for the line fitting respectively (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Position X [mm]:** The X coordinate of the point with maximum negative distance from the line.
- **Depth [mm]:** The maximum negative distance from the line.

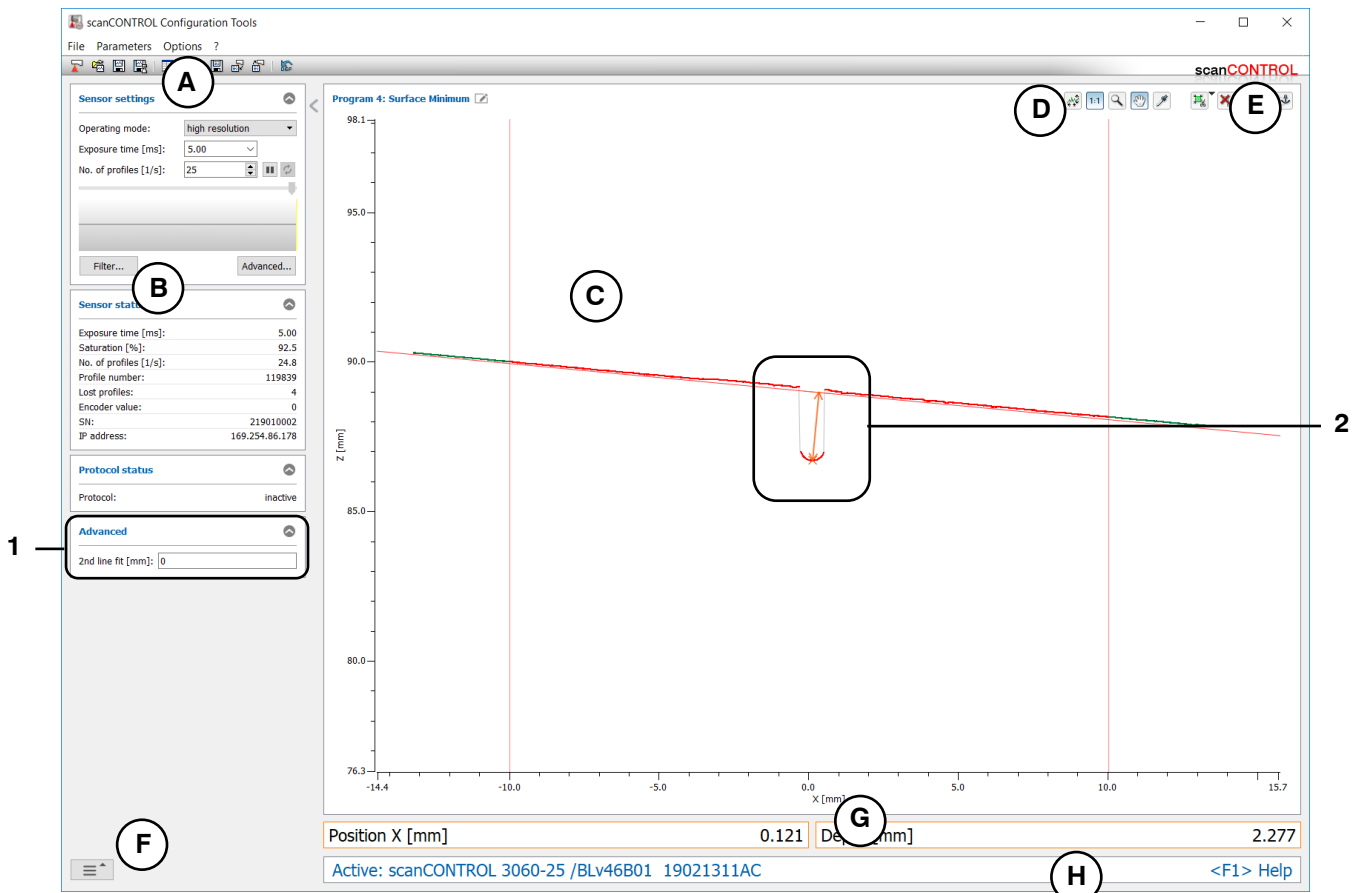


Fig. 4.24: "Surface Minimum" measuring program

Display elements and parameters in the "Surface Minimum" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1** Advanced settings:
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - 2** **Display of the results:** In the 2D-display, the point determined by the measuring program is represented by an orange cross. The maximum negative distance is indicated by an arrow.

4.5 "Seam" Group

Programs for inspecting heightenings, for example of beading or welds, can be found in the "Seam" group.

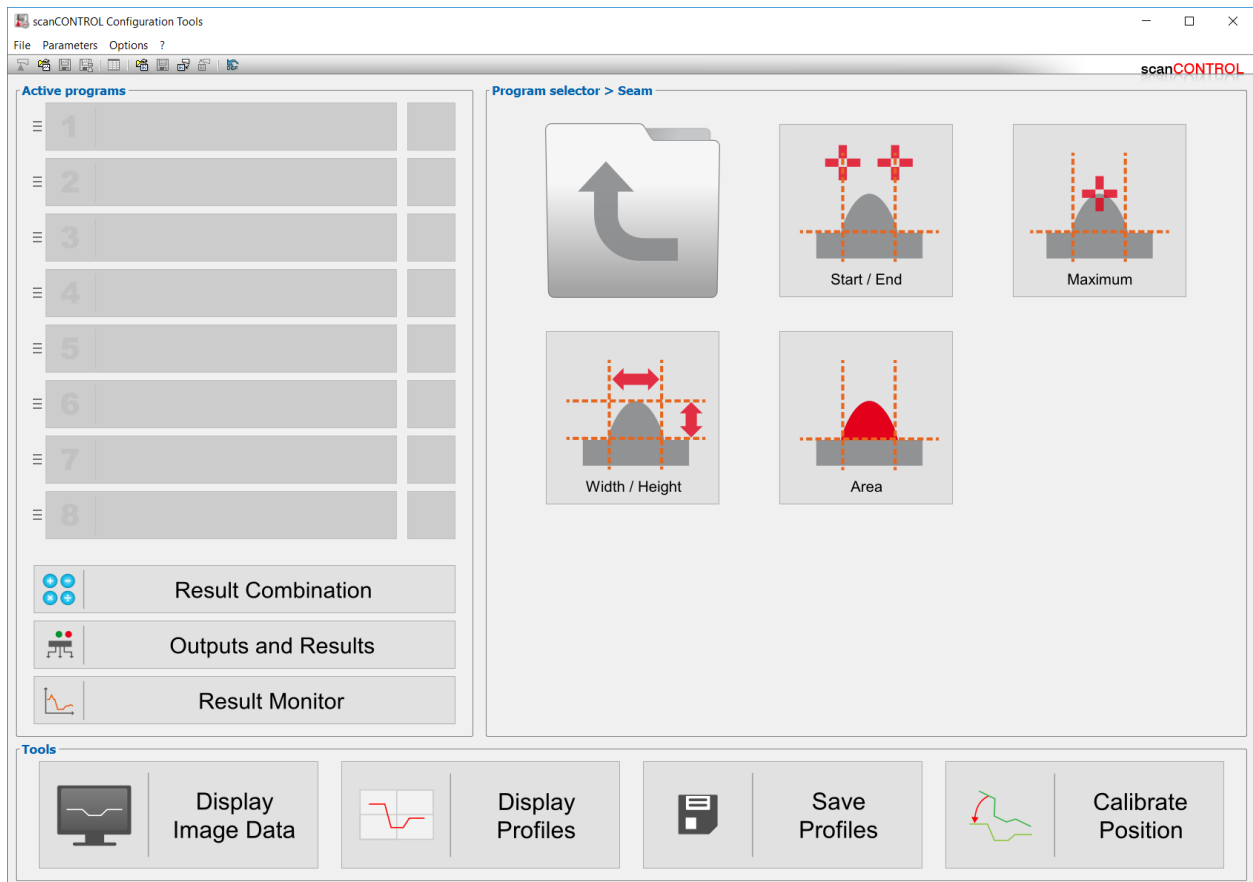


Fig. 4.25: "Seam" group













Measuring programs in the "Seam" group:

- Start/End: Determination of a heightening and calculation of the X coordinates of the start and end point.
- Maximum: Determination of a heightening and calculation of the coordinates of the point with maximum height.
- Width/Height: Determination of a heightening and calculation of its width and height.
- Area: Determination of a heightening and calculation of its area.

4.5.1 "Seam Start/End" Measuring Program

Use the "Seam Start/End" measuring program to determine the start and end point of a significant heightening or a gap. For example, such a heightening can be a bead or weld. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum height relative to the reference line is specified. A heightening is detected for existing profile points above the minimum height. To detect a gap, no profile point above the minimum height is necessary. The measuring program then determines the start and the end point of the heightening or of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of heightening (see Fig. 4.27 and Chapter 3.13.1):
 - The heightening is located between two reference ranges which are on the same level .
 - The heightening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the heightening .
 - There is a reference range which is located on the right side of the heightening .
- Define the search direction for the detection of the heightening (see Fig. 4.26):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The heightening is searched from left and right.
 - Left and right step: The heightening is searched from left and right.
 - Left: The heightening is searched from left.
 - Right: The heightening is searched from right.
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the heightening ( see Chapter 3.13.6).

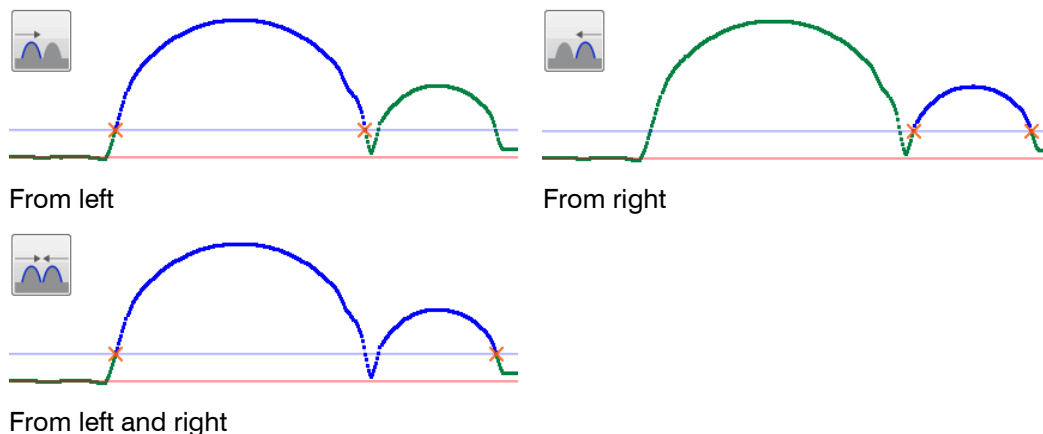


Fig. 4.26: Algorithms for the search direction

The measuring program outputs the following measured values:

- **Start X [mm]:** The X coordinate of the start point of the heightening.
- **End X [mm]:** The X coordinate of the end point of the heightening.

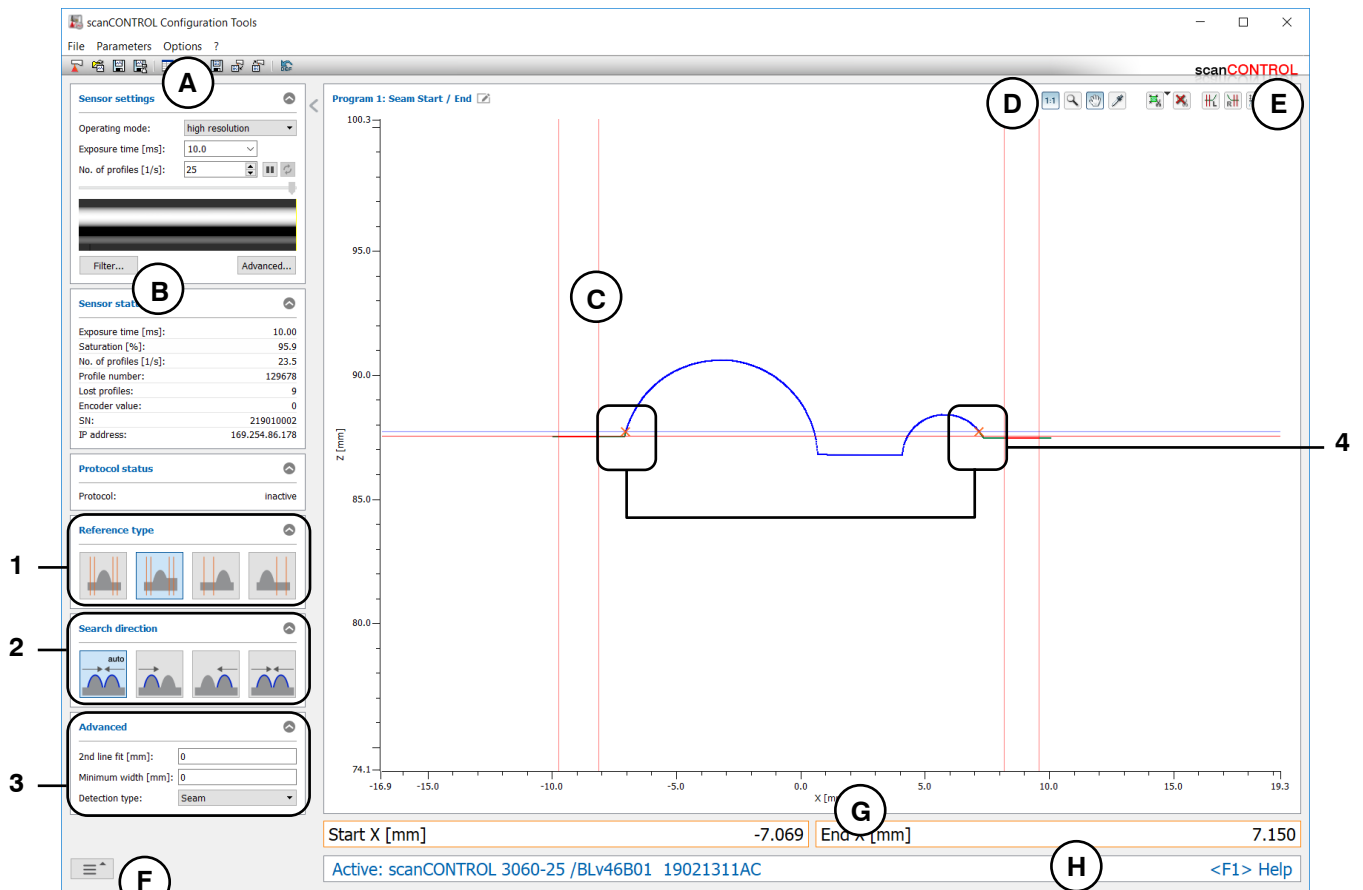





Fig. 4.27: "Seam Start/End" measuring program

Display elements and parameters in the "Seam Start/End" measuring program:













- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Reference type:** Select the type of heightening (see above) in this input field.
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
 - **Detection type:** Select the type of detection:
 - **Seam:** Detection of a heightening.
 - **Gap:** Detection of a gap. Select the algorithm for the gap detection:
 - Largest euclidean gap .
 - Largest gap in X direction .
 - Largest gap in Z direction .
- 4** **Display of the start and end point:** In the 2D-display, the start and end point determined by the measuring program are each represented by an orange cross.

4.5.2 "Seam Maximum" Measuring Program

Use the "Seam Maximum" measuring program to determine the maximum point of a significant heightening. For example, such a heightening can be a bead or weld. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum height relative to the reference line is specified. A heightening is detected for existing profile points above the minimum height and the measuring program then determines the point with maximum distance from the reference line.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of heightening (see Fig. 4.28 and Chapter 3.13.1):
 - The heightening is located between two reference ranges which are on the same level .
 - The heightening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the heightening .
 - There is a reference range which is located on the right side of the heightening .
- Define the search direction for the detection of the heightening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The heightening is searched from left and right.
 - Left and right step: The heightening is searched from left and right.
 - Left: The heightening is searched from left.
 - Right: The heightening is searched from right.
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Maximum X [mm]:** The X coordinate of the maximum point of the heightening.
- **Maximum Z [mm]:** The Z coordinate of the maximum point of the heightening.

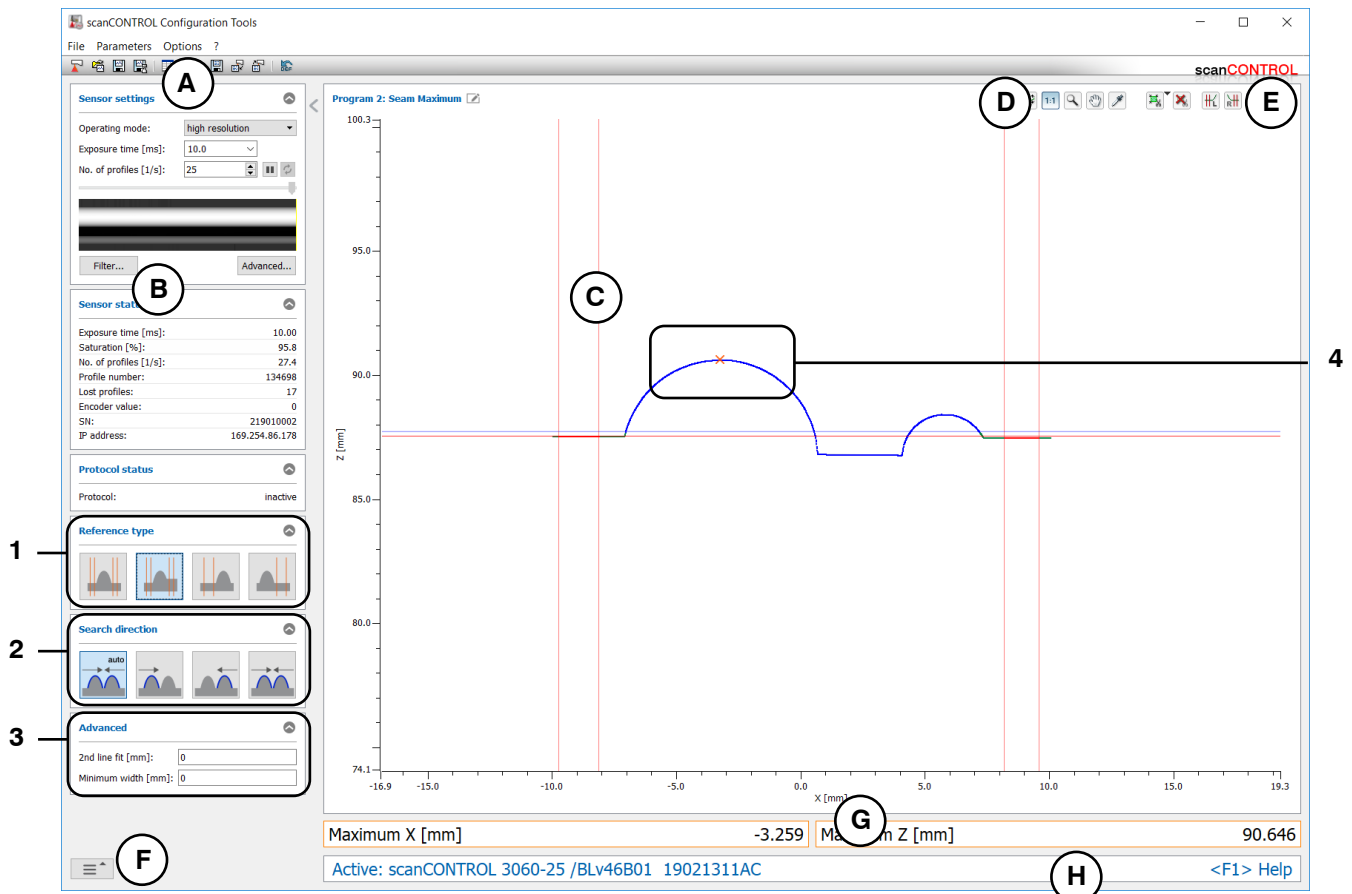


Fig. 4.28: "Seam Maximum" measuring program

Display elements and parameters in the "Seam Maximum" measuring program:













- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Reference type:** Select the type of heightening (see above) in this input field.
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.

- 3** **Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
- 4** **Display of the maximum point:** In the 2D-display, the maximum point determined by the measuring program is represented by an orange cross.

4.5.3 "Seam Width/Height" Measuring Program

Use the "Seam Width/Height" measuring program to determine the width and height of a significant heightening or the width of a gap. For example, such a heightening can be a bead or weld. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum height relative to the reference line is specified. A heightening is detected for existing profile points above the minimum height. To detect a gap, no profile point above the minimum height is necessary. The measuring program then determines the width and the height of the heightening or the width of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of heightening (see Fig. 4.29 and Chapter 3.13.1):
 - The heightening is located between two reference ranges which are on the same level .
 - The heightening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the heightening .
 - There is a reference range which is located on the right side of the heightening .
- Define the search direction for the detection of the heightening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The heightening is searched from left and right.
 - Left and right step: The heightening is searched from left and right.
 - Left: The heightening is searched from left.
 - Right: The heightening is searched from right.
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Width [mm]:** The width of the heightening.
- **Height [mm]:** The height of the heightening.

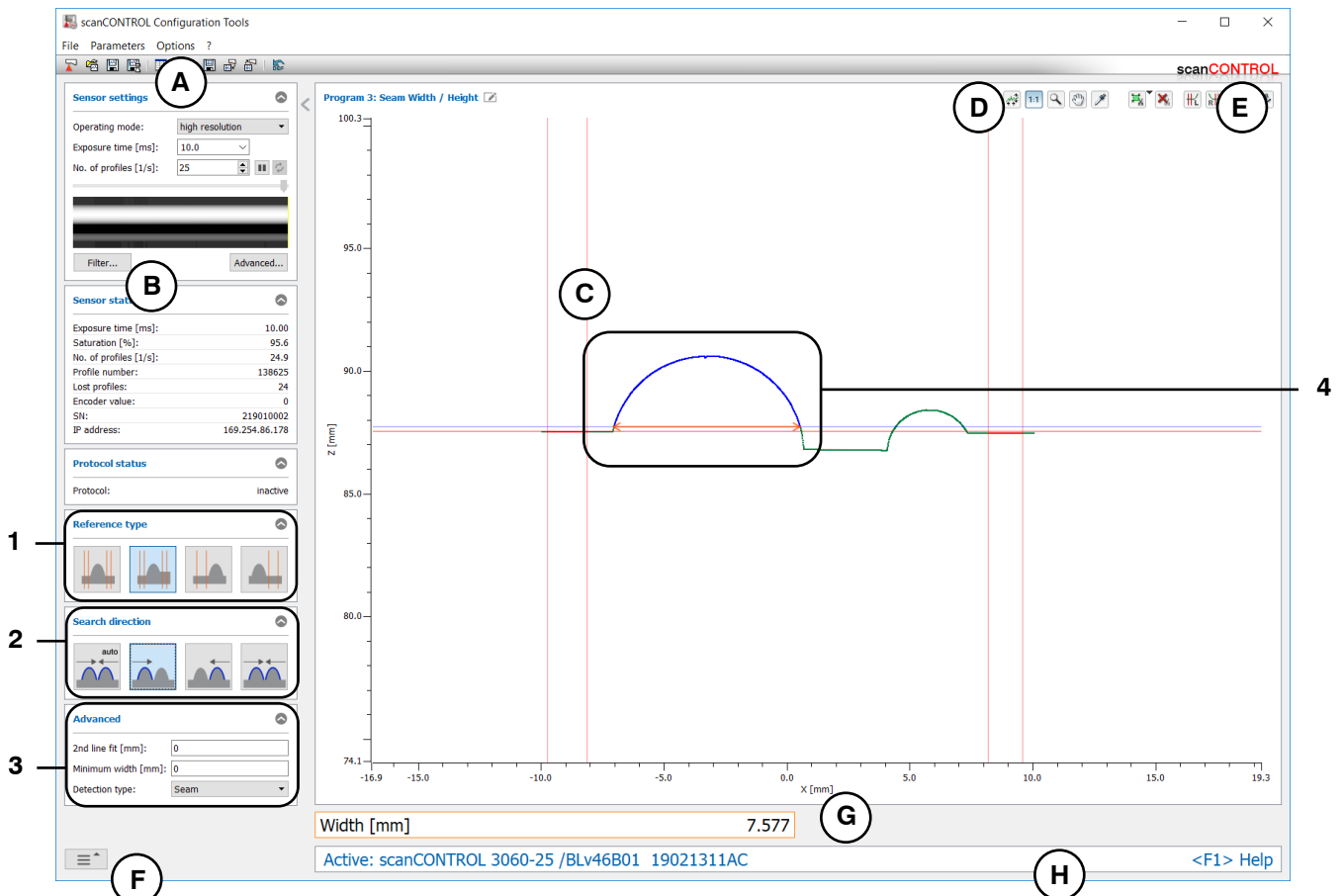





Fig. 4.29: "Seam Width/Height" measuring program

Display elements and parameters in the "Seam Width/Height" measuring program:













- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Reference type:** Select the type of heightening (see above) in this input field.
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
 - **Detection type:** Select the type of detection:
 - **Seam:** Detection of a heightening.
 - **Gap:** Detection of a gap. Select the algorithm for the gap detection:
 - Largest euclidean gap .
 - Largest gap in X direction .
 - Largest gap in Z direction .
- 4** **Display of the width and height:** In the 2D-display, the width and height determined by the measuring program are each represented by an orange arrow.

4.5.4 "Seam Area" Measuring Program

Use the "Seam Area" measuring program to determine the area of a significant heightening. For example, such a heightening can be a bead or weld. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum height relative to the reference line is specified. A heightening is detected for existing profile points above the minimum height and the measuring program then determines the area of the heightening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of heightening (see Fig. 4.30 and Chapter 3.13.1):
 - The heightening is located between two reference ranges which are on the same level .
 - The heightening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the heightening .
 - There is a reference range which is located on the right side of the heightening .
- Define the search direction for the detection of the heightening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The heightening is searched from left and right.
 - Left and right step: The heightening is searched from left and right.
 - Left: The heightening is searched from left.
 - Right: The heightening is searched from right.
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Area [mm²]:** The area of the heightening.

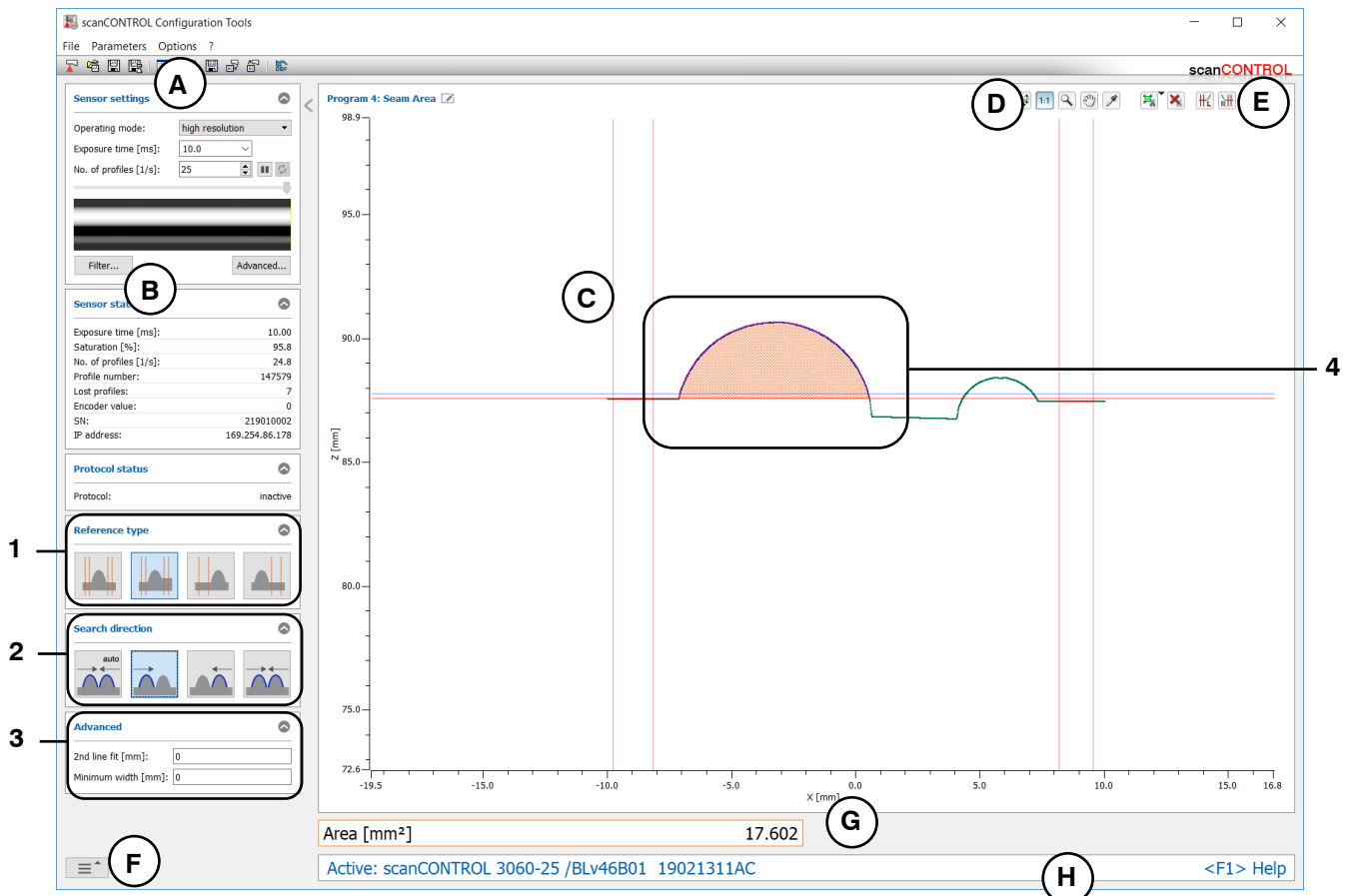


Fig. 4.30: "Seam Area" measuring program

Display elements and parameters in the "Seam Area" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1** **Reference type:** Select the type of heightening (see above) in this input field.
 - 2** **Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width:** Enter the minimum width of the heightening.
- 4** **Display of the area:** In the 2D-display, the area determined by the measuring program is displayed hatched.

4.6 "Groove" Group

Programs for inspecting deepenings, for example of a groove or a gap, can be found in the "Groove" group.

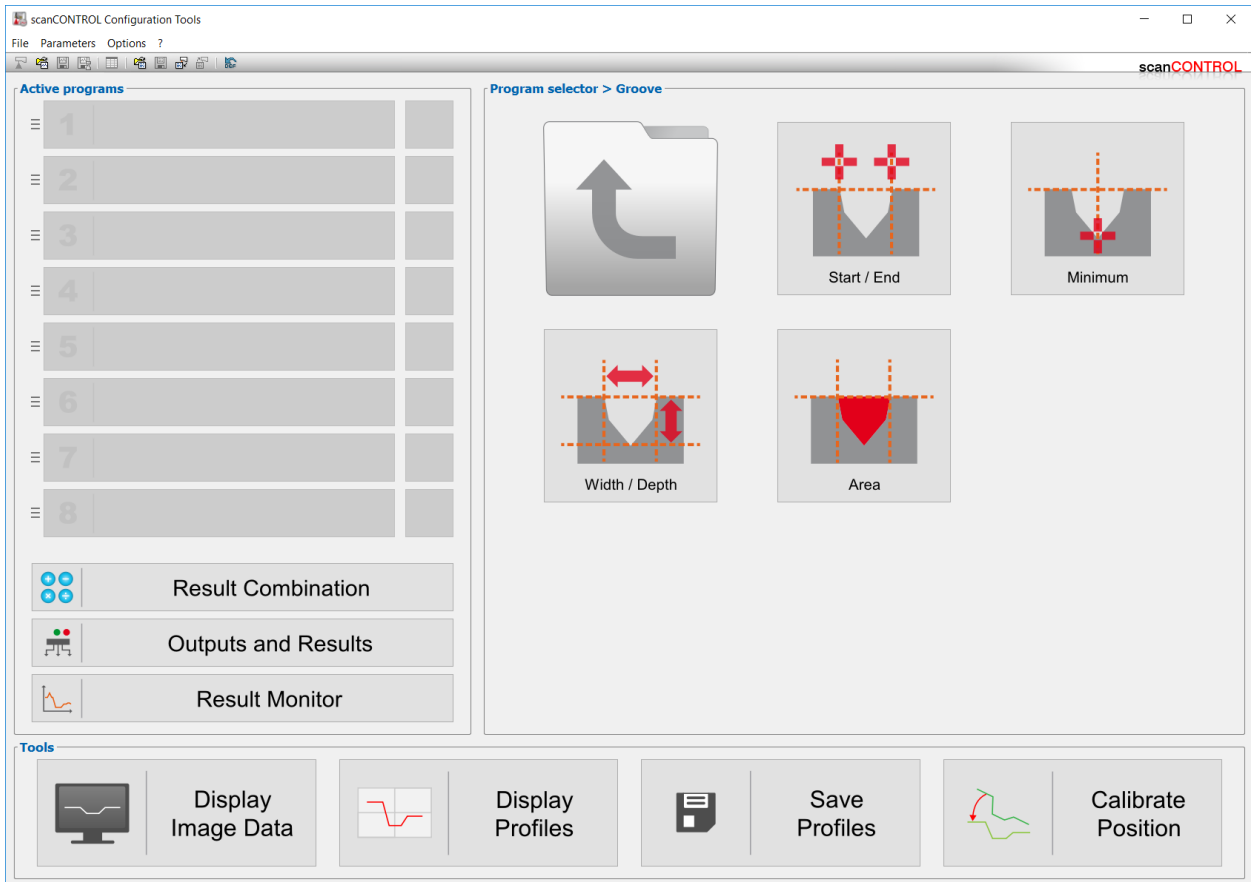


Fig. 4.31: "Groove" group













Measuring programs in the "Groove" group:

- **Start/End:** Determination of a deepening and calculation of the X coordinates of the start and end point.
- **Minimum:** Determination of a deepening and calculation of the coordinates of the point with maximum depth.
- **Width/Depth:** Determination of a deepening and calculation of its width and depth.
- **Area:** Determination of a deepening and calculation of its area.

4.6.1 "Groove Start/End" Measuring Program

Use the "Groove Start/End" measuring program to determine the start and end point of a significant deepening or of a gap. For example, such a deepening can be a groove. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum depth relative to the reference line is specified. A deepening is detected for existing profile points below the minimum depth. To detect a gap, no profile point below the minimum depth is necessary. The measuring program then determines the start and the end point of the deepening or of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of deepening (see Fig. 4.32 and Chapter 3.13.1):
 - The deepening is located between two reference ranges which are on the same level .
 - The deepening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the deepening .
 - There is a reference range which is located on the right side of the deepening .
- Define the search direction for the detection of the deepening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The deepening is searched from left and right.
 - Left and right step: The deepening is searched from left and right.
 - Left: The deepening is searched from left.
 - Right: The deepening is searched from right.
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Start X [mm]:** The X coordinate of the start point of the deepening.
- **End X [mm]:** The X coordinate of the end point of the deepening.

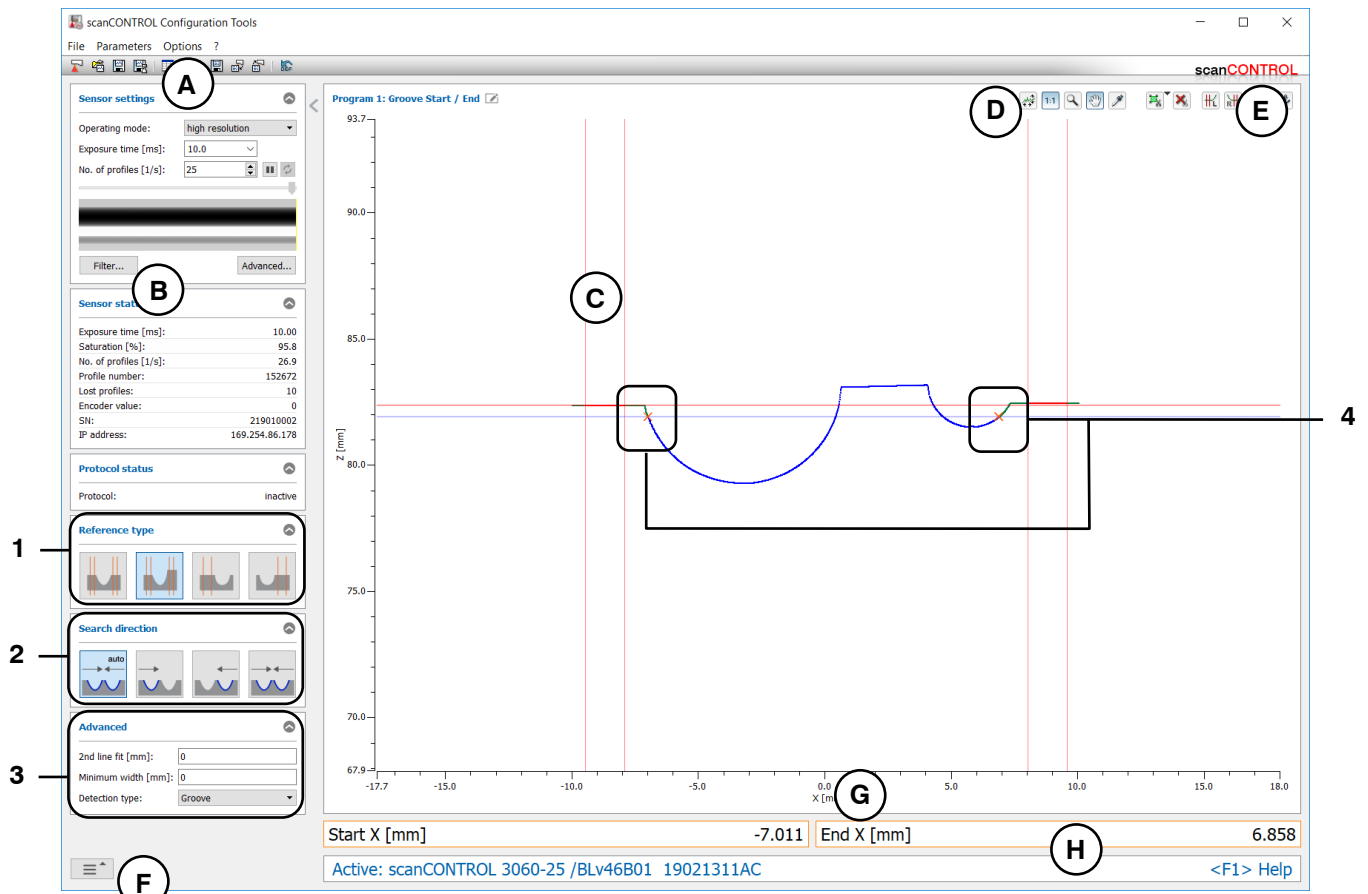





Fig. 4.32: "Groove Start/End" measuring program

Display elements and parameters in the "Groove Start/End" measuring program:













- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Type of deepening:** Select the type of deepening (see above) in this input field.
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width [mm]:** Enter the minimum width of the deepening.
 - **Detection type:** Select the type of detection:
 - **Groove:** Detection of a deepening.
 - **Gap:** Detection of a gap. Select the algorithm for the gap detection:
 - Largest euclidean gap .
 - Largest gap in X direction .
 - Largest gap in Z direction .
- 4** **Display of the start and end point:** In the 2D-display, the start and end point determined by the measuring program are each represented by an orange cross.

4.6.2 "Groove Minimum" Measuring Program

Use the "Groove Minimum" measuring program to determine the minimum point of a significant deepening. For example, such a deepening can be a groove. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum depth relative to the reference line is specified. A deepening is detected for existing profile points below the minimum depth and the measuring program then determines the point with maximum distance from the reference line.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of deepening (see Fig. 4.33 and Chapter 3.13.1):
 - The deepening is located between two reference ranges which are on the same level .
 - The deepening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the deepening .
 - There is a reference range which is located on the right side of the deepening .
- Define the search direction for the detection of the deepening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The deepening is searched from left and right.
 - Left and right step: The deepening is searched from left and right.
 - Left: The deepening is searched from left.
 - Right: The deepening is searched from right.
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Minimum X [mm]:** The X coordinate of the minimum point of the deepening.
- **Minimum Z [mm]:** The Z coordinate of the minimum point of the deepening.

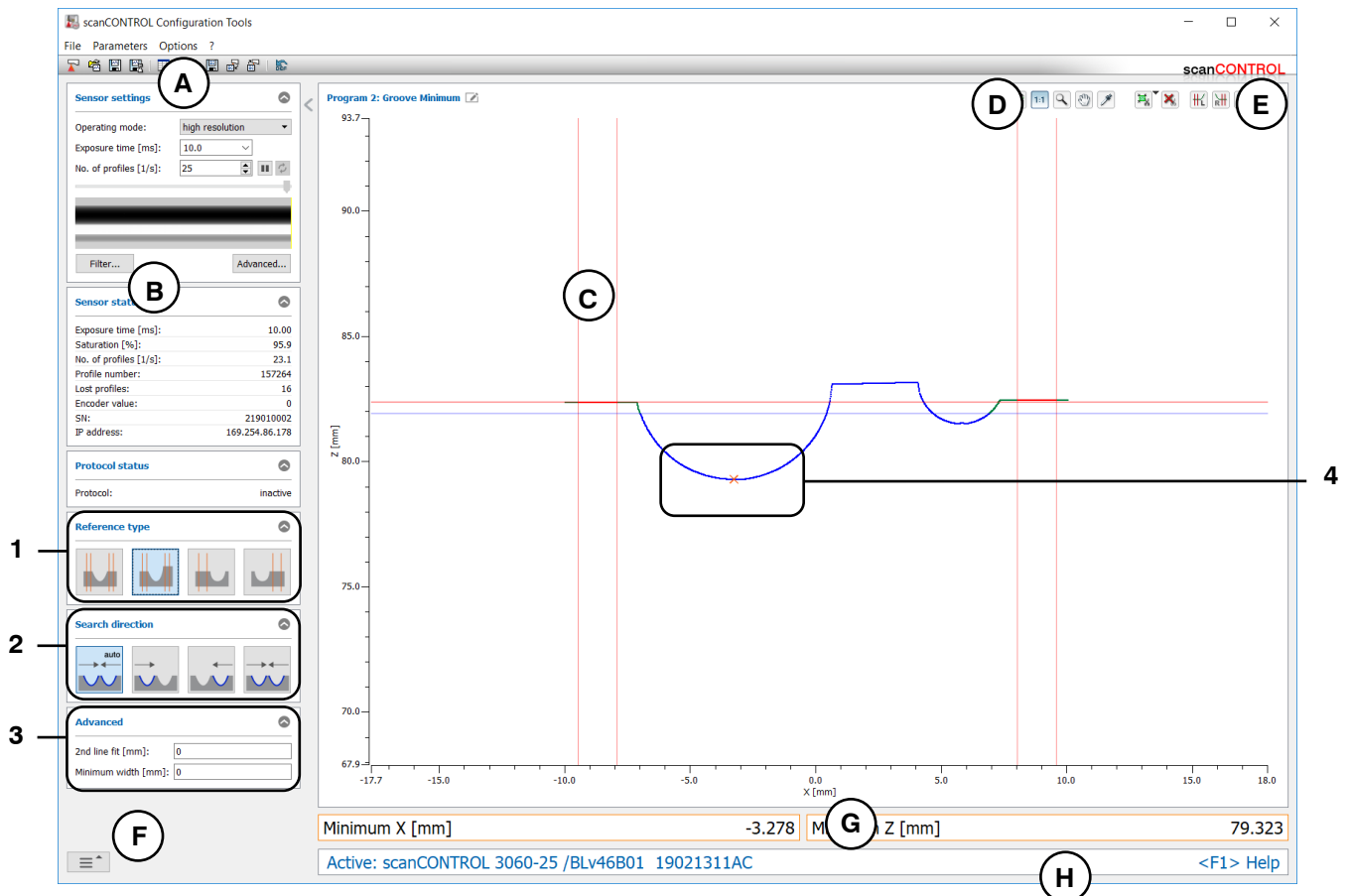


Fig. 4.33: "Groove Minimum" measuring program

Display elements and parameters in the "Groove Minimum" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1** **Type of deepening:** Select the type of deepening (see above) in this input field.
 - 2** **Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.













- 3** **Advanced settings:**
 - **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width:** Enter the minimum width of the deepening.

- 4** **Display of the minimum point:** In the 2D-display, the minimum point determined by the measuring program is represented by an orange cross.

4.6.3 "Groove Width/Depth" Measuring Program

Use the "Groove Width/Depth" measuring program to determine the width and depth of a significant deepening or the width of a gap. For example, such a deepening can be a groove. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum depth relative to the reference line is specified. A deepening is detected for existing profile points below the minimum depth. To detect a gap, no profile point below the minimum depth is necessary. The measuring program then determines the width and depth of the deepening or the width of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of deepening (see Fig. 4.34 and Chapter 3.13.1):
 - The deepening is located between two reference ranges which are on the same level .
 - The deepening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the deepening .
 - There is a reference range which is located on the right side of the deepening .
- Define the search direction for the detection of the deepening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The deepening is searched from left and right.
 - Left and right step: The deepening is searched from left and right.
 - Left: The deepening is searched from left.
 - Right: The deepening is searched from right.
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Width [mm]:** The width of the deepening.
- **Depth [mm]:** The depth of the deepening.

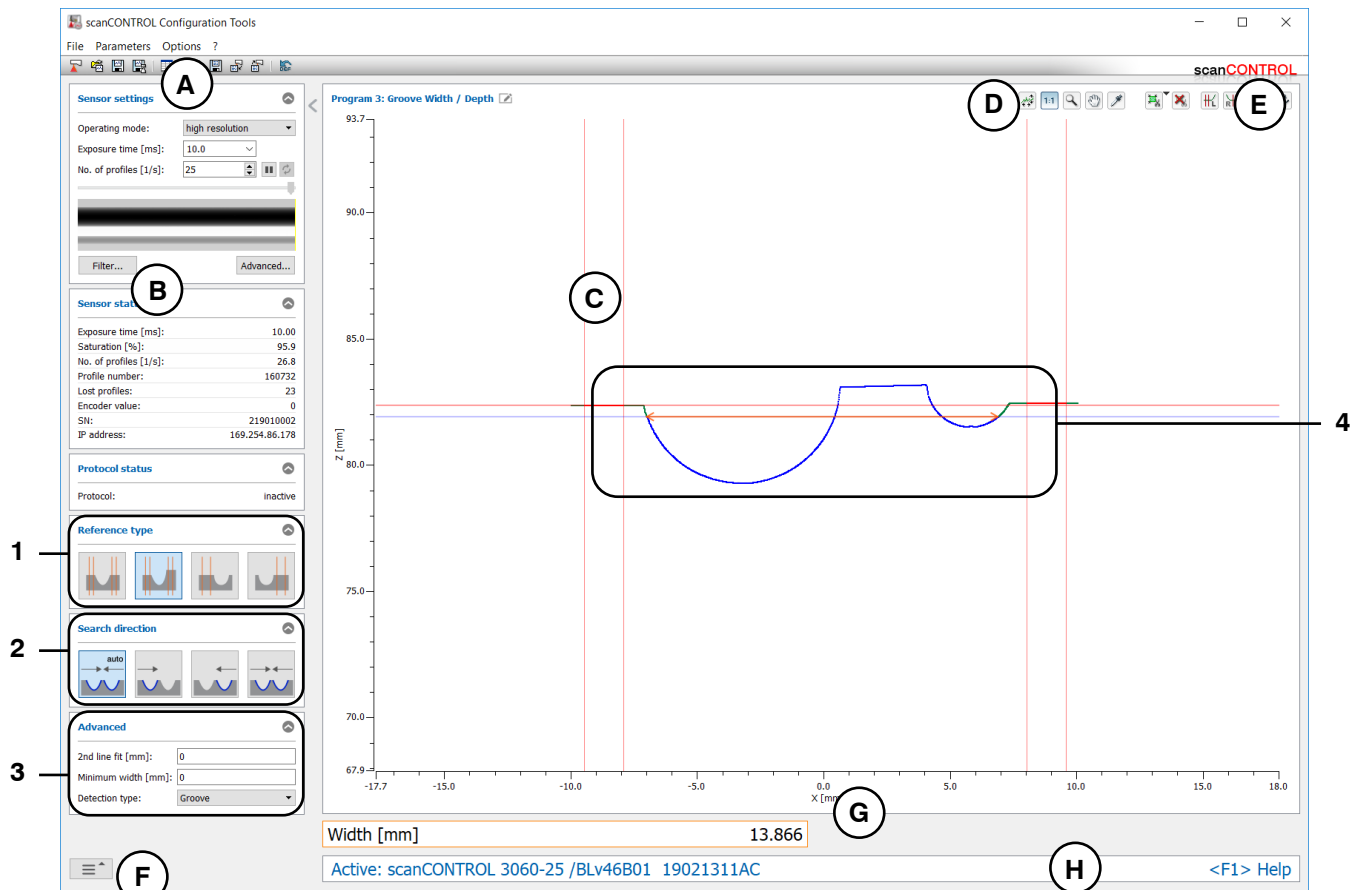





Fig. 4.34: "Groove Width/Depth" measuring program

Display elements and parameters in the "Groove Width/Depth" measuring program:













- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Type of deepening:** Select the type of deepening (see above) in this input field.
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width [mm]:** Enter the minimum width of the deepening.
 - **Detection type:** Select the type of detection:
 - **Groove:** Detection of a deepening.
 - **Gap:** Detection of a gap. Select the algorithm for the gap detection:
 - Largest euclidean gap .
 - Largest gap in X direction .
 - Largest gap in Z direction .
- 4** **Display of the width and depth:** In the 2D-display, the width and depth determined by the measuring program are each represented by an orange arrow.

4.6.4 "Groove Area" Measuring Program

Use the "Groove Area" measuring program to determine the area of a significant deepening. For example, such a deepening can be a groove. The program first determines a reference line which is determined by line fitting in up to two adjustable ranges (so-called reference ranges). A minimum depth relative to the reference line is specified. A deepening is detected for existing profile points below the minimum depth and the measuring program then determines the area of the deepening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of deepening (see Fig. 4.35 and Chapter 3.13.1):
 - The deepening is located between two reference ranges which are on the same level .
 - The deepening is located between two reference ranges which are on different, parallel levels .
 - There is a reference range which is located on the left side of the deepening .
 - There is a reference range which is located on the right side of the deepening .
- Define the search direction for the detection of the deepening (see Fig. 4.26 Chapter 4.5.1):
 - The search direction is set automatically depending on the reference type:
 - Left and right: The deepening is searched from left and right.
 - Left and right step: The deepening is searched from left and right.
 - Left: The deepening is searched from left.
 - Right: The deepening is searched from right.
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the range/ranges in which the reference line should be fitted to the profile points (  see Chapter 3.13.4).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the line fitting and for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Area [mm²]:** The area of the deepening.

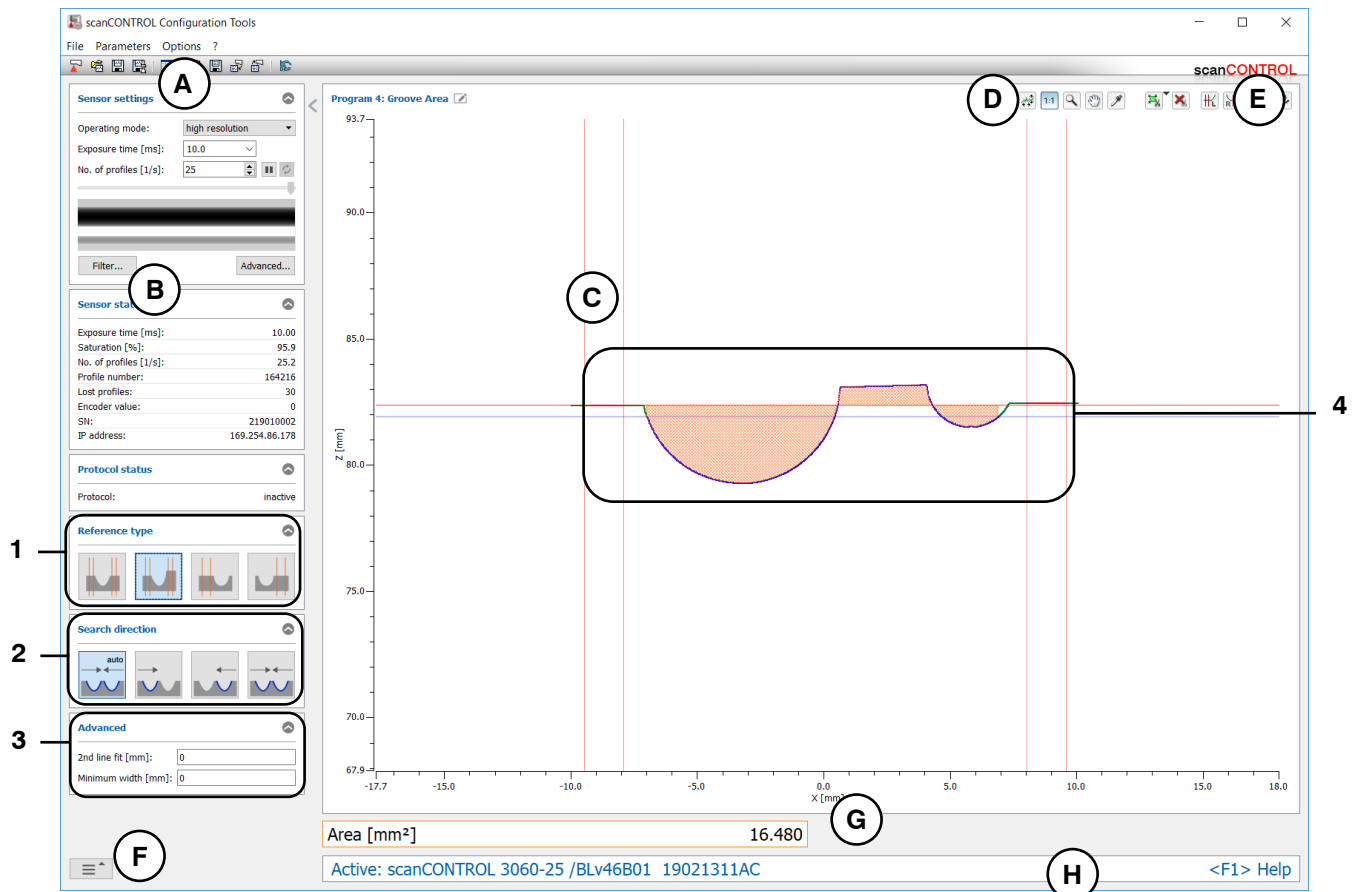


Fig. 4.35: "Groove Area" measuring program

Display elements and parameters in the "Groove Area" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G** **Results display:** The results of the current valid measurement are displayed.
 - H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1** **Type of deepening:** Select the type of deepening (see above) in this input field.
 - 2** **Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.

- 3** **Advanced settings:**
- **2nd line fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points in the selected range are used that are no further than [selected value]mm from the first fitting.
 - **Minimum width:** Enter the minimum width of the deepening.
- 4** **Display of the area:** In the 2D-display, the area determined by the measuring program is displayed hatched.

4.7 "Gap" Group

Programs for inspecting gaps.

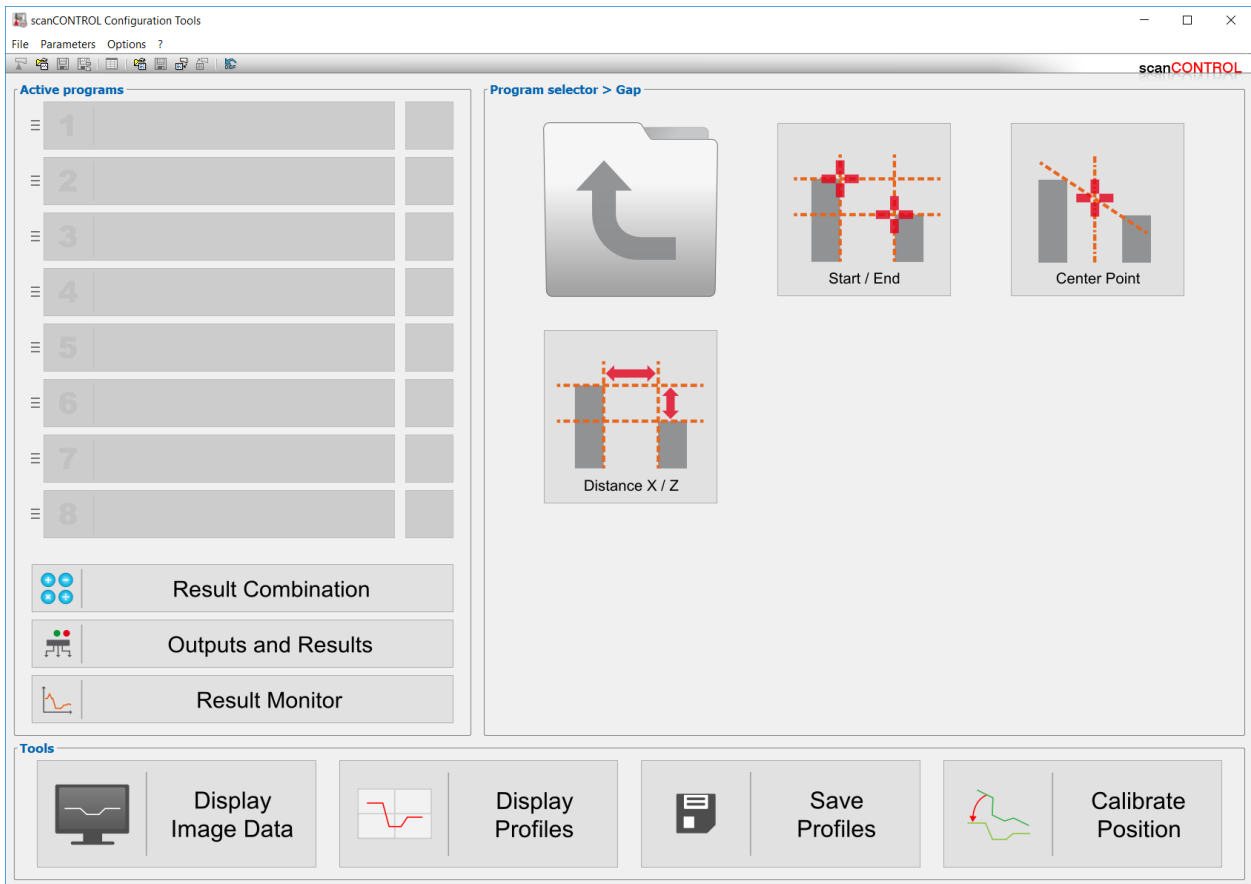


Fig. 4.36: "Gap" group






Measuring programs in the "Gap" group:

- **Start/End:** Determination of a gap and calculation of the X coordinates of the start and end point.
- **Center Point:** Determination of a gap and calculation of the coordinates of the center point.
- **Distance X/Z:** Determination of a gap and calculation of the distance between its start and end point in X and Z direction.

4.7.1 "Gap Start/End" Measuring Program

Use the "Gap Start/End" measuring program to determine the start and end point of a gap. The program first determines the largest gap in the profile. The measuring program determines the start and end point of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of gap detection (see Fig. 4.37):
 - Largest euclidean gap 
 - Largest gap in X direction 
 - Largest gap in Z direction 
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Start X [mm]:** The X coordinate of the start point of the gap.
- **End X [mm]:** The X coordinate of the end point of the gap.

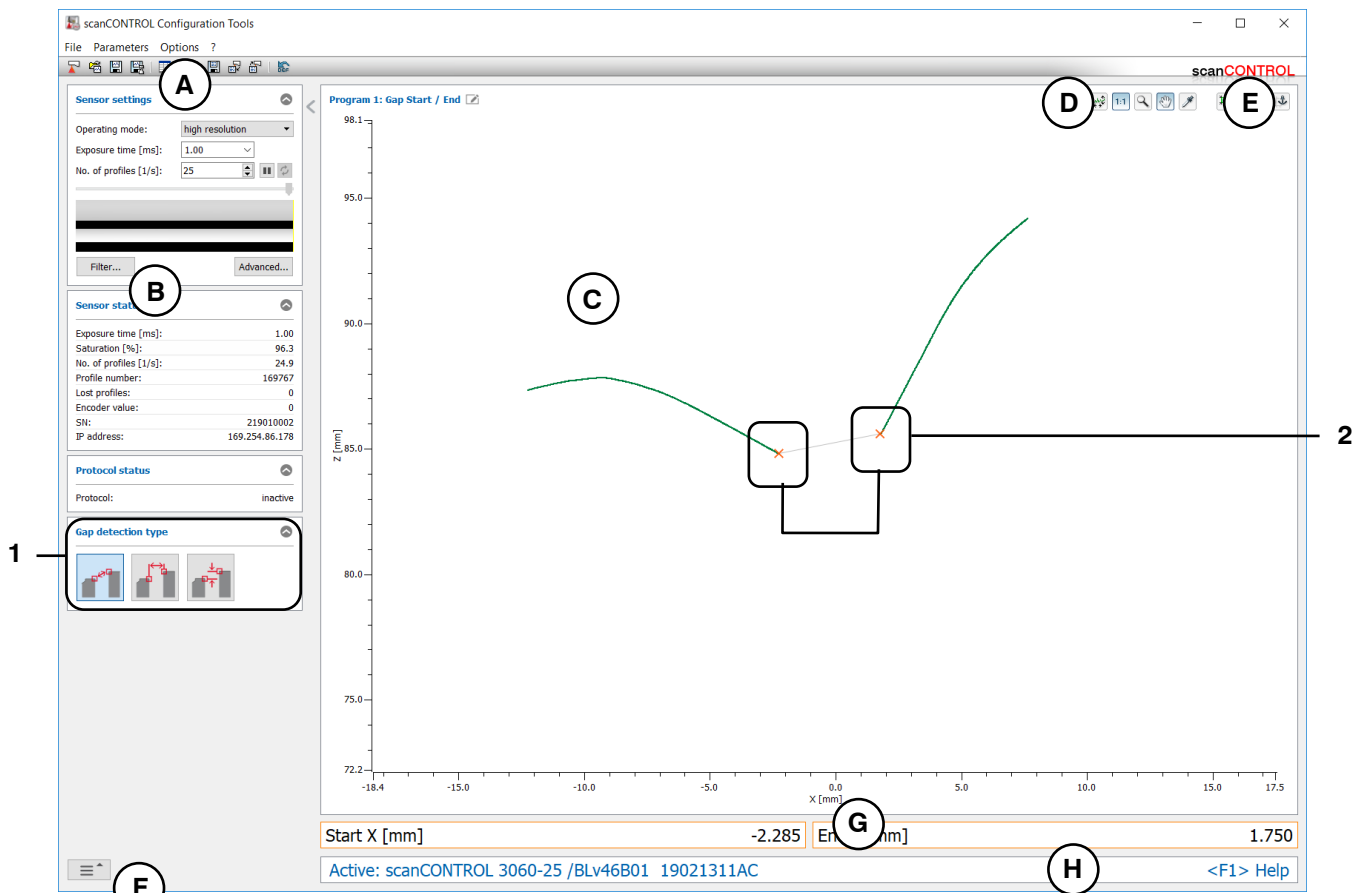


Fig. 4.37: "Gap Start/End" measuring program






Display elements and parameters in the "Gap Start/End" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Gap detection type:** Select the type of gap detection (see above) in this input field.
 - 2 Display of the start and end point:** In the 2D-display, the start and end point determined by the measuring program are each represented by an orange cross.

4.7.2 "Gap Center Point" Measuring Program

Use the "Gap Center Point" measuring program to determine the center point of a gap. The program first determines the largest gap in the profile. The measuring program determines the center point of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of gap detection (see Fig. 4.38):
 - Largest euclidean gap 
 - Largest gap in X direction 
 - Largest gap in Z direction 
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Center point X [mm]:** The X coordinate of the center point of the gap.
- **Center point Z [mm]:** The Z coordinate of the center point of the gap.

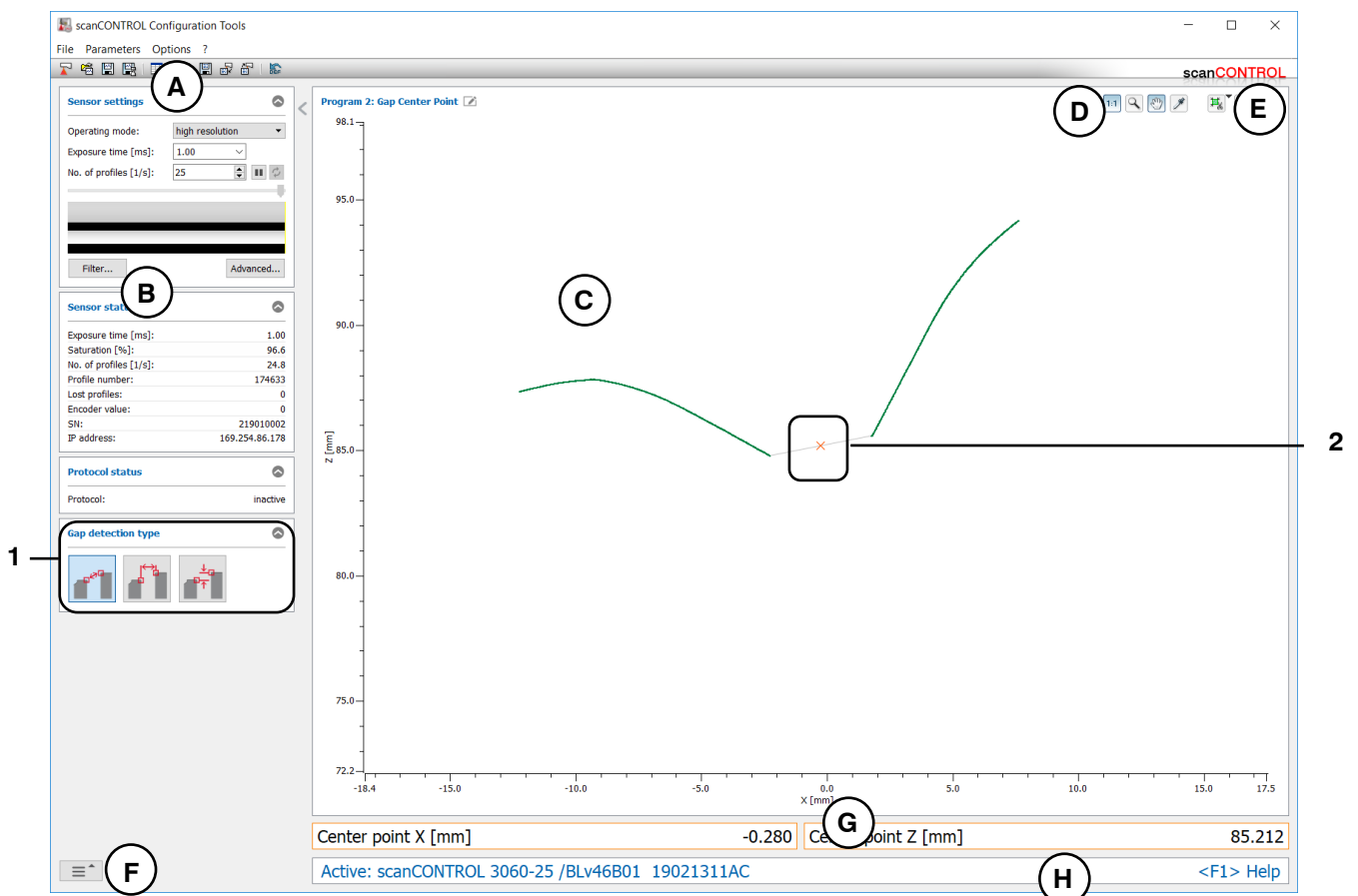


Fig. 4.38: "Gap Center Point" measuring program






Display elements and parameters in the "Gap Center Point" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Gap detection type:** Select the type of gap detection (see above) in this input field.
 - 2 Display of the center point:** In the 2D-display, the center point determined by the measuring program is represented by an orange cross.

4.7.3 "Gap Distance X/Z" Measuring Program

Use the "Gap Distance X/Z" measuring program to determine the distance between the start and end point of a gap in X and Z direction. The program first determines the largest gap in the profile. Then the measuring program determines the X and the Z distance of the gap.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Define the type of gap detection (see Fig. 4.39):
 - Largest euclidean gap .
 - Largest gap in X direction .
 - Largest gap in Z direction .
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Distance X [mm]:** The distance between the start and end point of the gap in X direction.
- **Distance Z [mm]:** The distance between the start and end point of the gap in Z direction.

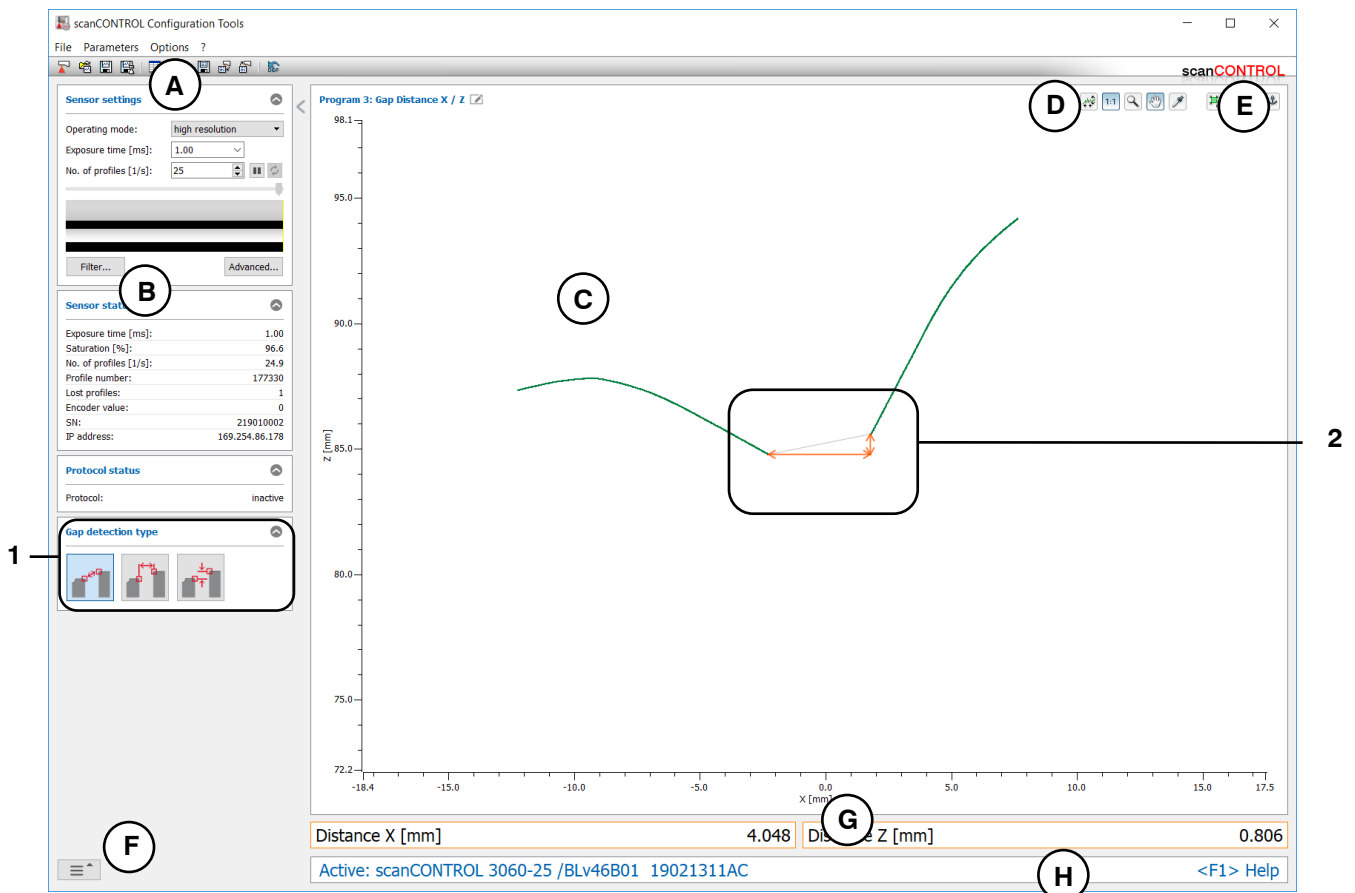


Fig. 4.39: "Gap Distance X/Z" measuring program

Display elements and parameters in the "Gap Distance X/Z" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Gap detection type:** Select the type of gap detection (see above) in this input field.
 - 2 Display of the X and Z distance:** In the 2D-display, the X and Z distance determined by the measuring program are each represented by an orange arrow.

4.8 "Circle" Group

Programs for inspecting circles.

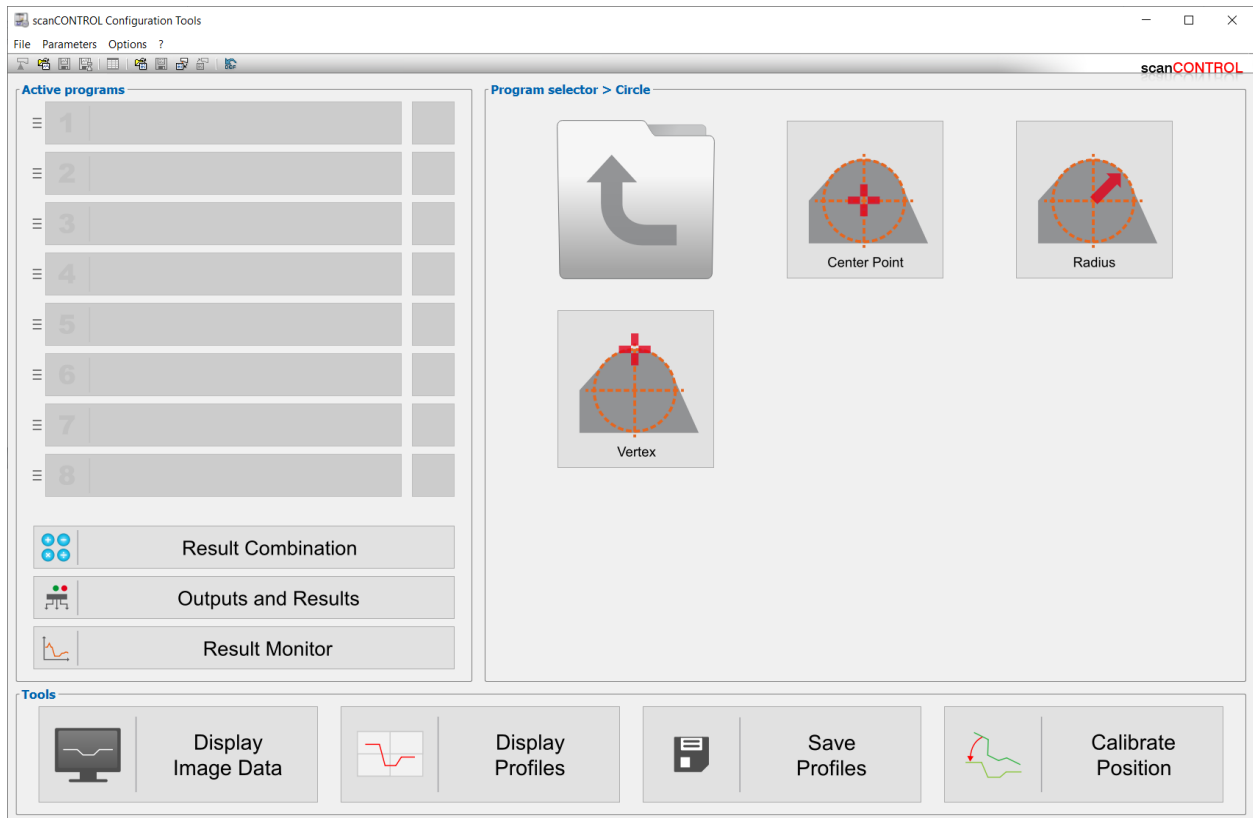


Fig. 4.40: "Circle" group

Measuring programs in the "Circle" group:

- Center: Determination of a circle and calculation of the X and Z coordinates of the center point.
- Radius: Determination of a circle and calculation of the radius.
- Vertex: Determination of a circle and calculation of the vertex.

4.8.1 "Circle Center Point" Measuring Program

Use the "Circle Center Point" measuring program to determine the center point of a circle. The program first determines the circle, which is calculated by a circle fit. Then the measuring program determines the center point of the circle.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Center X [mm]:** The X coordinate of the center point of the circle.
- **Center Z [mm]:** The Z coordinate of the center point of the circle.

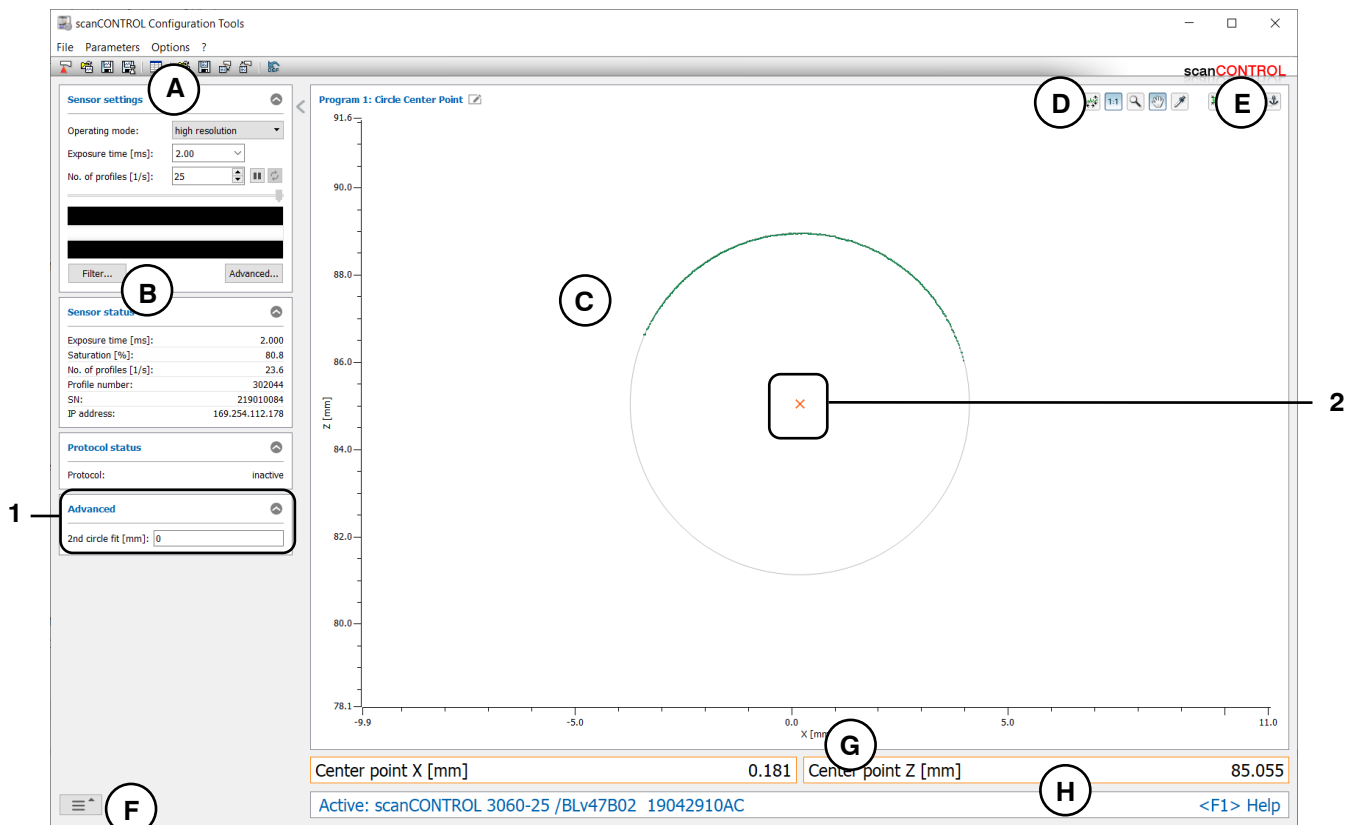


Fig. 4.41: "Circle Center Point" measuring program

Display elements and parameters in the "Circle Center Point" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Advanced settings:**
 - **2nd circle fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points are used that are no further than [selected value]mm from the first fitting.
 - 2 Display of the center point:** In the 2D-display, the center point determined by the measuring program is represented by an orange cross.

4.8.2 "Circle Radius" Measuring Program

Use the "Circle Radius" measuring program to determine the radius of a circle. The program first determines the circle, which is calculated by a circle fit. Then the measuring program determines the radius of the circle.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Radius [mm]:** The radius of the circle.

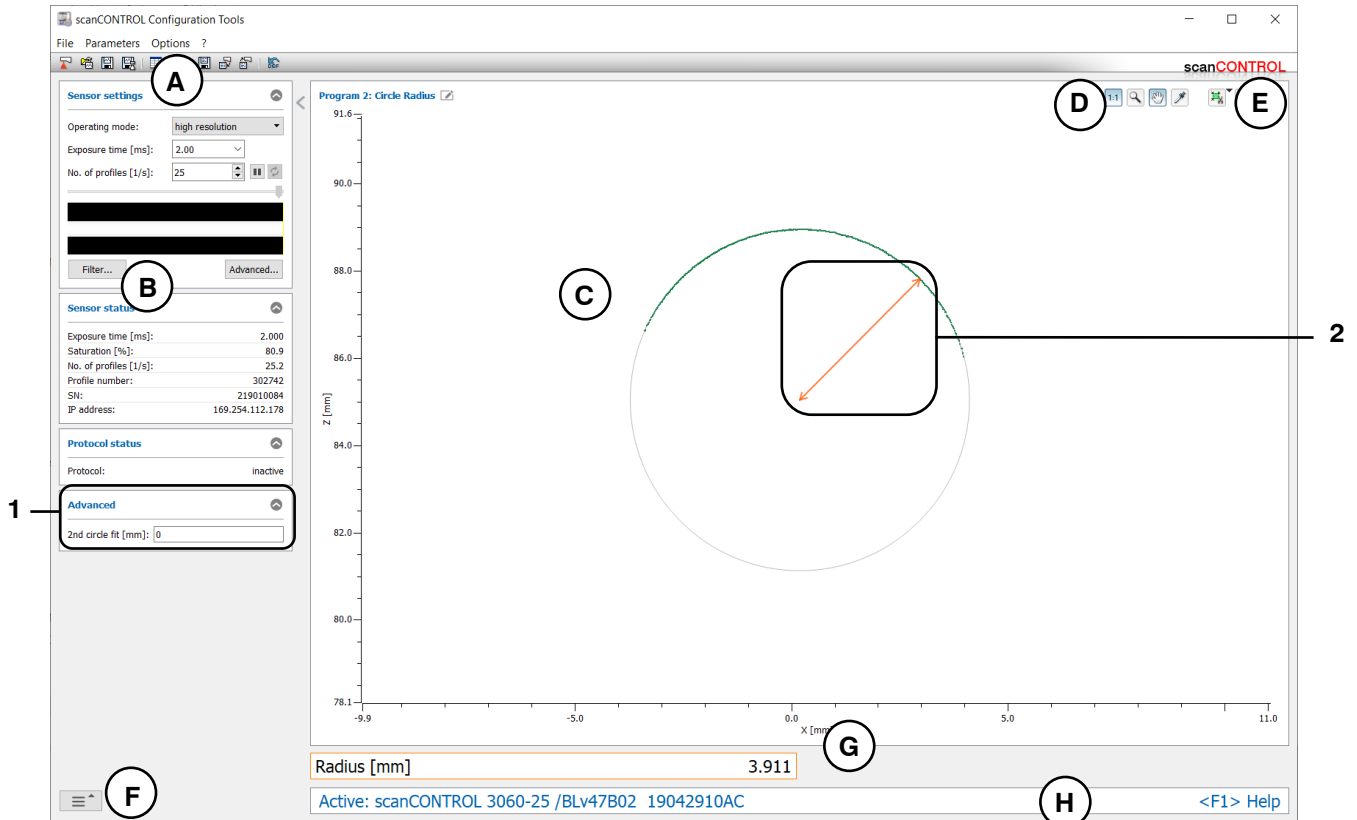


Fig. 4.42: "Circle Radius" measuring program

Display elements and parameters in the "Circle Radius" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd circle fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the radius:** In the 2D-display, the radius determined by the measuring program is represented by an orange arrow.

4.8.3 "Circle Vertex" Measuring Program

Use the "Circle Vertex" measuring program to determine the vertex of a circle. The program first determines the circle, which is calculated by a circle fit. Then the measuring program determines the vertex of the circle. If the profile section for the circle fitting is convex, then the vertex is the circle point with the minimum Z coordinate, and for a concave profile section accordingly the vertex is the circle point with the maximum Z coordinate.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, activate the dynamic tracking for the measuring range (see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Vertex X [mm]:** The X coordinate of the vertex of the circle.
- **Vertex Z [mm]:** The Z coordinate of the vertex of the circle.

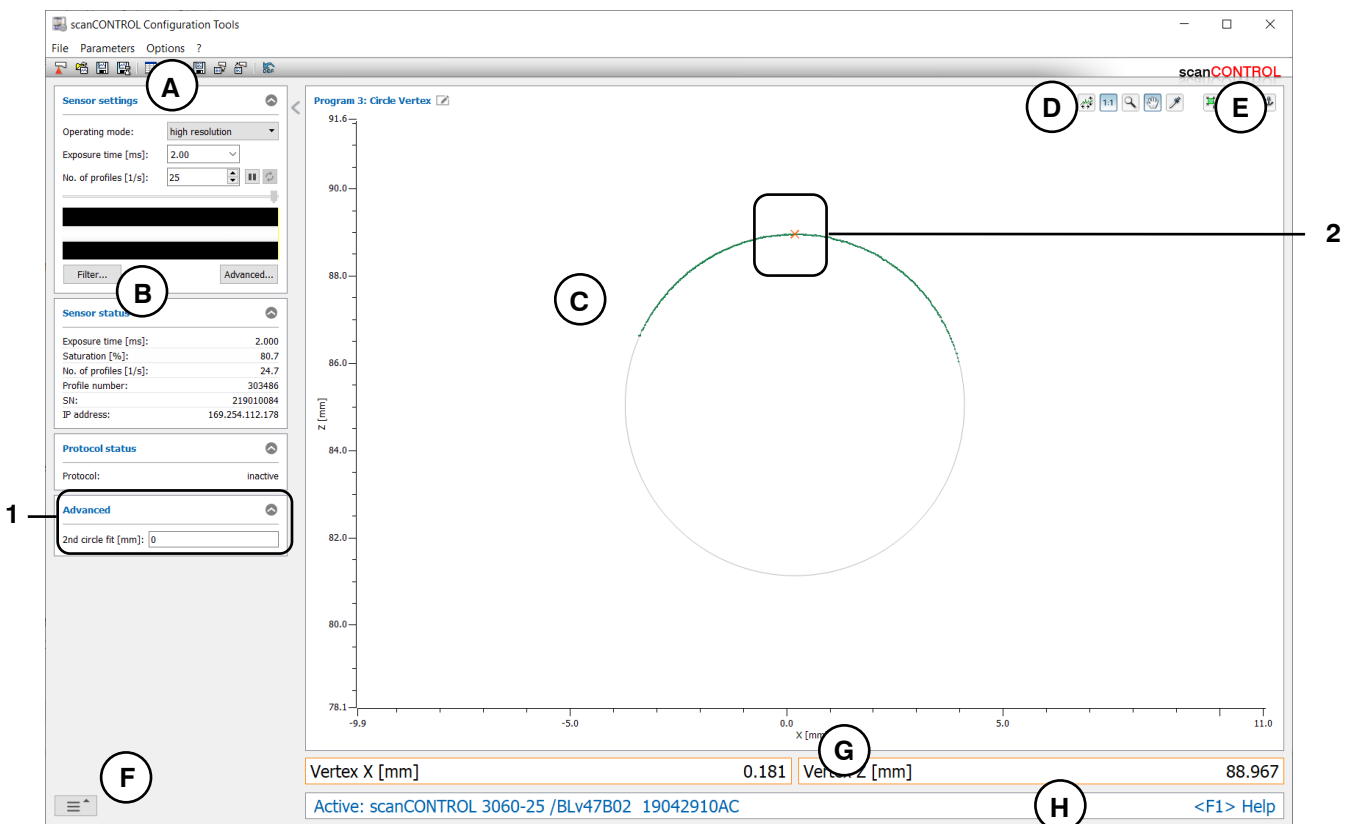


Fig. 4.43: "Circle Vertex" measuring program

Display elements and parameters in the "Circle Vertex" measuring program:

- A** **"General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B** **Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C** **2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
- D** **"Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E** **"Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F** **Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G** **Results display:** The results of the current valid measurement are displayed.
- H** **Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

- 1** Advanced settings:
 - **2nd circle fit [mm]:** If this parameter is > 0 , a second fitting is performed for which only those measuring points are used that are no further than [selected value]mm from the first fitting.
- 2** **Display of the vertex:** In the 2D-display, the vertex determined by the measuring program is represented by an orange cross.

4.9 "Circle Seam" Group

Programs for inspecting heightenings, for example of beading or welds on circular profile sections, can be found in the "Circle Seam" group.

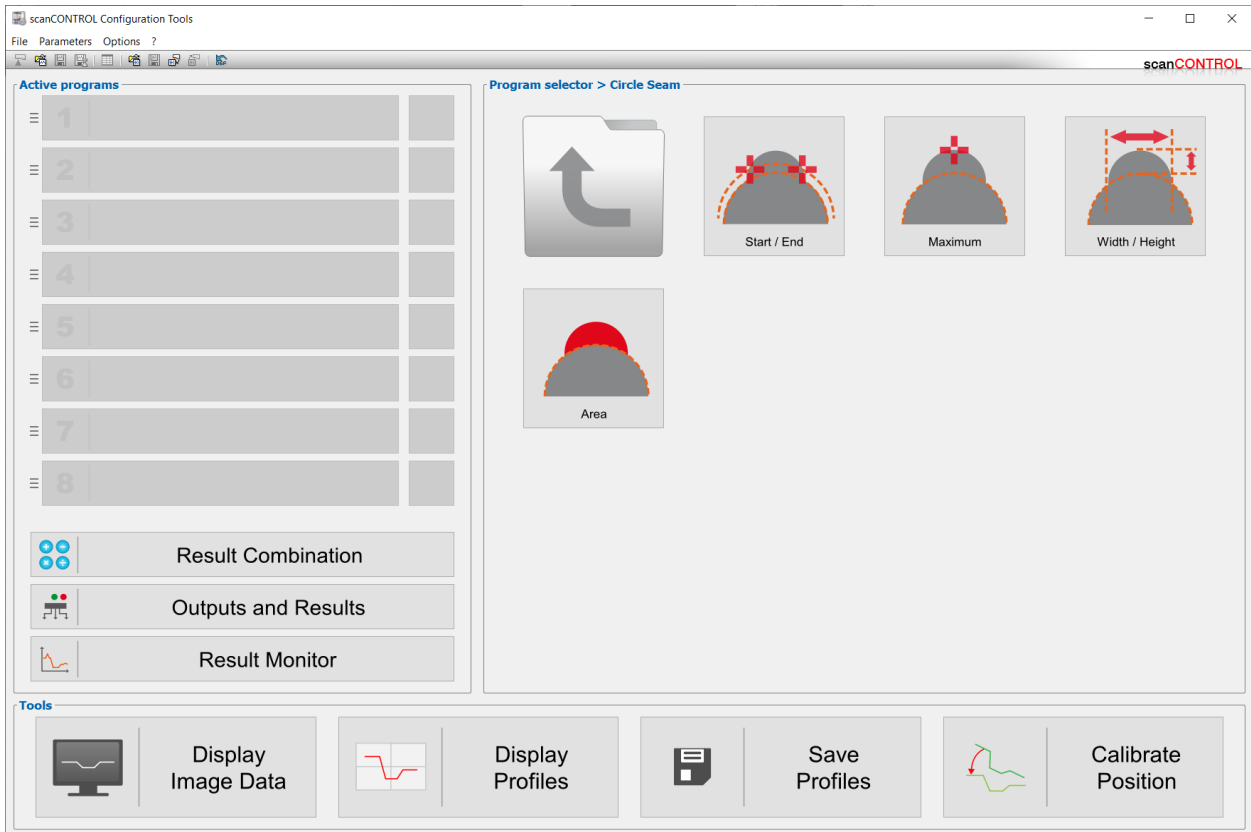


Fig. 4.44: "Circle Seam" group







Measuring programs in the "Circle Seam" group:

- Circle Start/End: Determination of a heightening and calculation of the X coordinates of the start and end point.
- Circle Maximum: Determination of a heightening and calculation of the coordinates of the point with maximum height.
- Circle Width/Height: Determination of a heightening and calculation of its width and height.
- Circle Area: Determination of a heightening and calculation of its area.

4.9.1 "Circle Seam Start/End" Measuring Program

Use the "Circle Seam Start/End" measuring program to determine the start and end point of a significant heightening on circular profile sections. For example, such a heightening can be a bead or weld. The program uses a reference circle from the selected predecessor measuring program. A minimum height relative to the reference circle is specified (so-called threshold circle). A heightening is detected for existing profile points outside the reference circle. The measuring program then determines the start and the end point of the heightening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the heightening (see Fig. 4.45):
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening. The width of the heightening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the the detection of the heightening ( see Chapter 3.13.6).

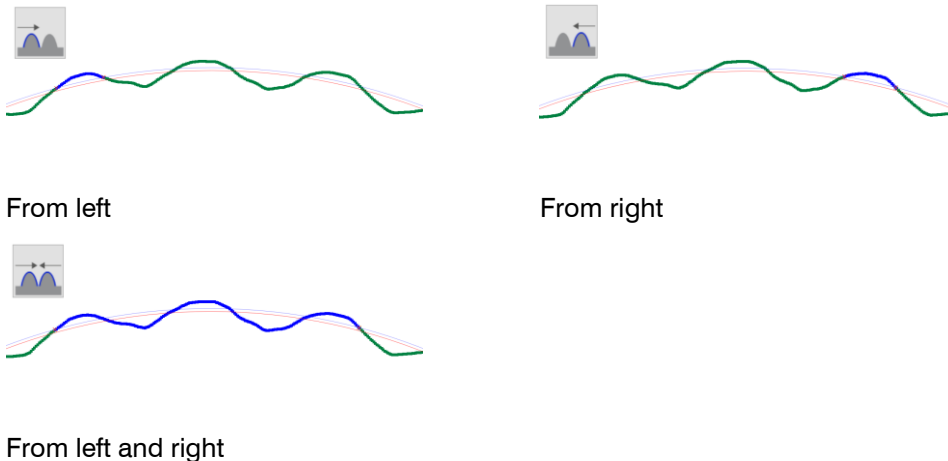


Fig. 4.45: Algorithms for the search direction

The measuring program outputs the following measured values:

- **Start X [mm]:** The X coordinate of the start point of the heightening.
- **End X [mm]:** The X coordinate of the end point of the heightening.

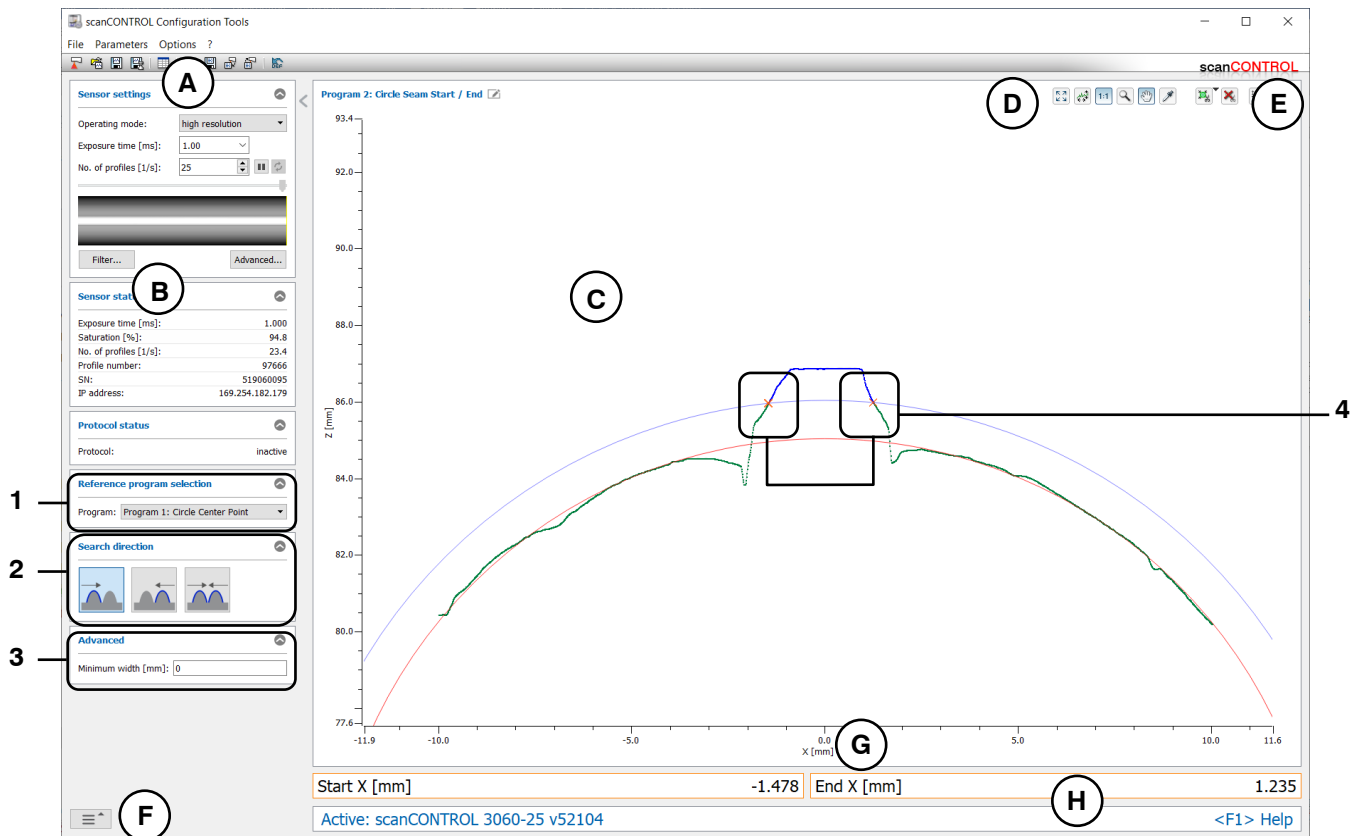


Fig. 4.46: "Circle Seam Start/End" measuring program







Display elements and parameters in the "Circle Seam Start/End" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
 - 4 Display of the start and end point:** In the 2D-display, the start and end point determined by the measuring program are each represented by an orange cross.

4.9.2 "Circle Seam Maximum" Measuring Program

Use the "Circle Seam Maximum" measuring program to determine the maximum point of a significant heightening. For example, such a heightening can be a bead or weld on circular profile sections. The program uses a reference circle from the selected predecessor measuring program. A minimum height relative to the reference circle is specified (so-called threshold circle). A heightening is detected for existing profile points outside the reference circle and the measuring program then determines the point with maximum distance from the reference circle.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the heightening (see Fig. 4.45):
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening. The width of the heightening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Maximum X [mm]:** The X coordinate of the maximum point of the heightening.
- **Maximum Z [mm]:** The Z coordinate of the maximum point of the heightening.

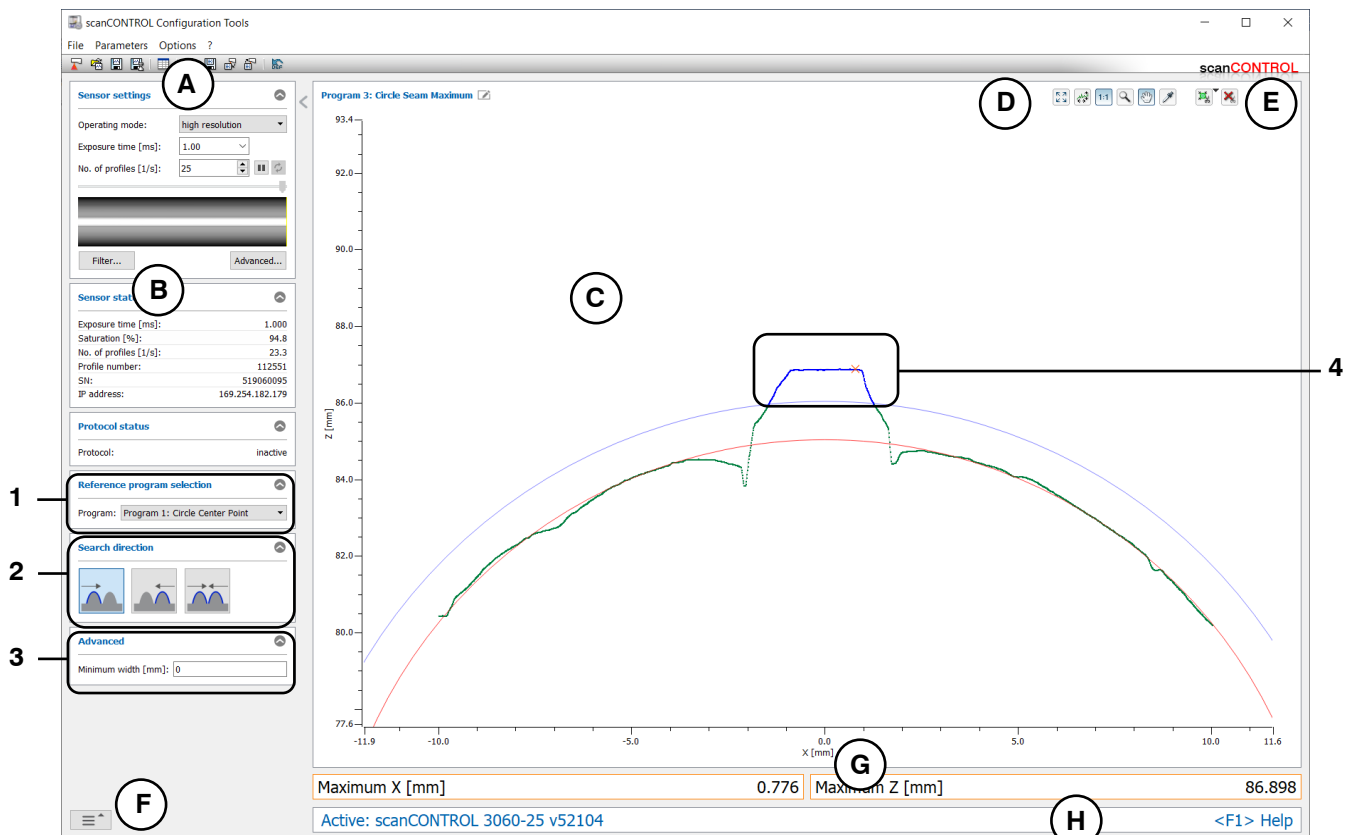


Fig. 4.47: "Circle Seam Maximum" measuring program







Display elements and parameters in the "Circle Seam Maximum" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
 - 4 Display of the maximum point:** In the 2D-display, the maximum point determined by the measuring program is represented by an orange cross.

4.9.3 "Circle Seam Width/Height" Measuring Program

Use the "Circle Seam Width/Height" measuring program to determine the width and height of a significant heightening on circular profile sections. For example, such a heightening can be a bead or weld. The program uses a reference circle from the selected predecessor measuring program. A minimum height relative to the reference circle is specified (so-called threshold circle). A heightening is detected for existing profile points outside the reference circle. The measuring program then determines the width and the height of the heightening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the heightening (see Fig. 4.45):
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening. The width of the heightening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Width [mm]:** The width of the heightening.
- **Height [mm]:** The height of the heightening.

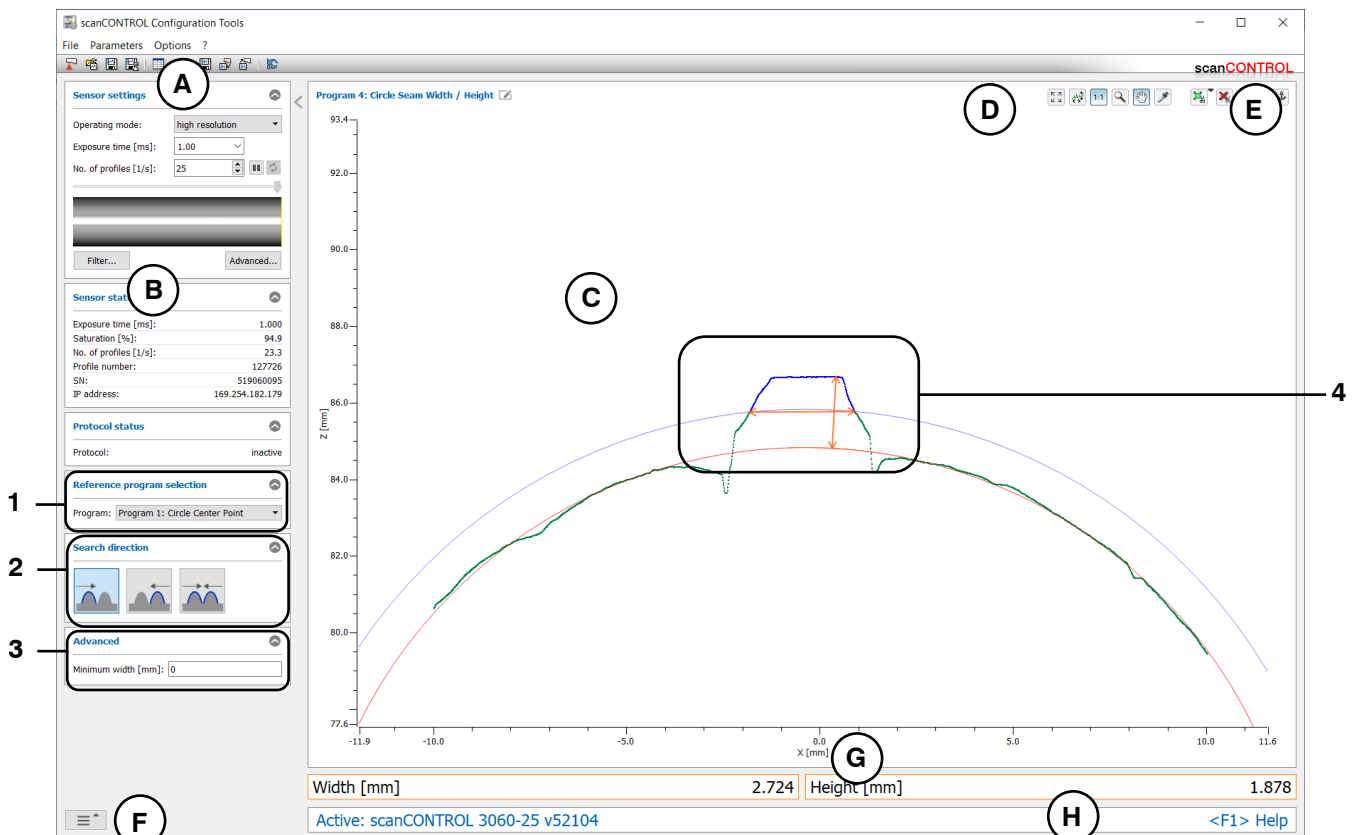


Fig. 4.48: "Circle Seam Width/Height" measuring program







Display elements and parameters in the "Circle Seam Width/Height" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width [mm]:** Enter the minimum width of the heightening.
 - 4 Display of the width and height:** In the 2D-display, the width and height determined by the measuring program are each represented by an orange arrow.

4.9.4 "Circle Seam Area" Measuring Program

Use the "Circle Seam Area" measuring program to determine the area of a significant heightening on circular profile sections. For example, such a heightening can be a bead or weld. The program uses a reference circle from the selected predecessor measuring program. A minimum height relative to the reference circle is specified (so-called threshold circle). A heightening is detected for existing profile points outside the reference circle and the measuring program then determines the area of the heightening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the heightening (see Fig. 4.45):
 - The heightening is searched from left .
 - The heightening is searched from right .
 - The heightening is searched from left and right .
- Enter the minimum width of the heightening. The width of the heightening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum height for the detection of the heightening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the heightening ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Area [mm²]:** The area of the heightening.

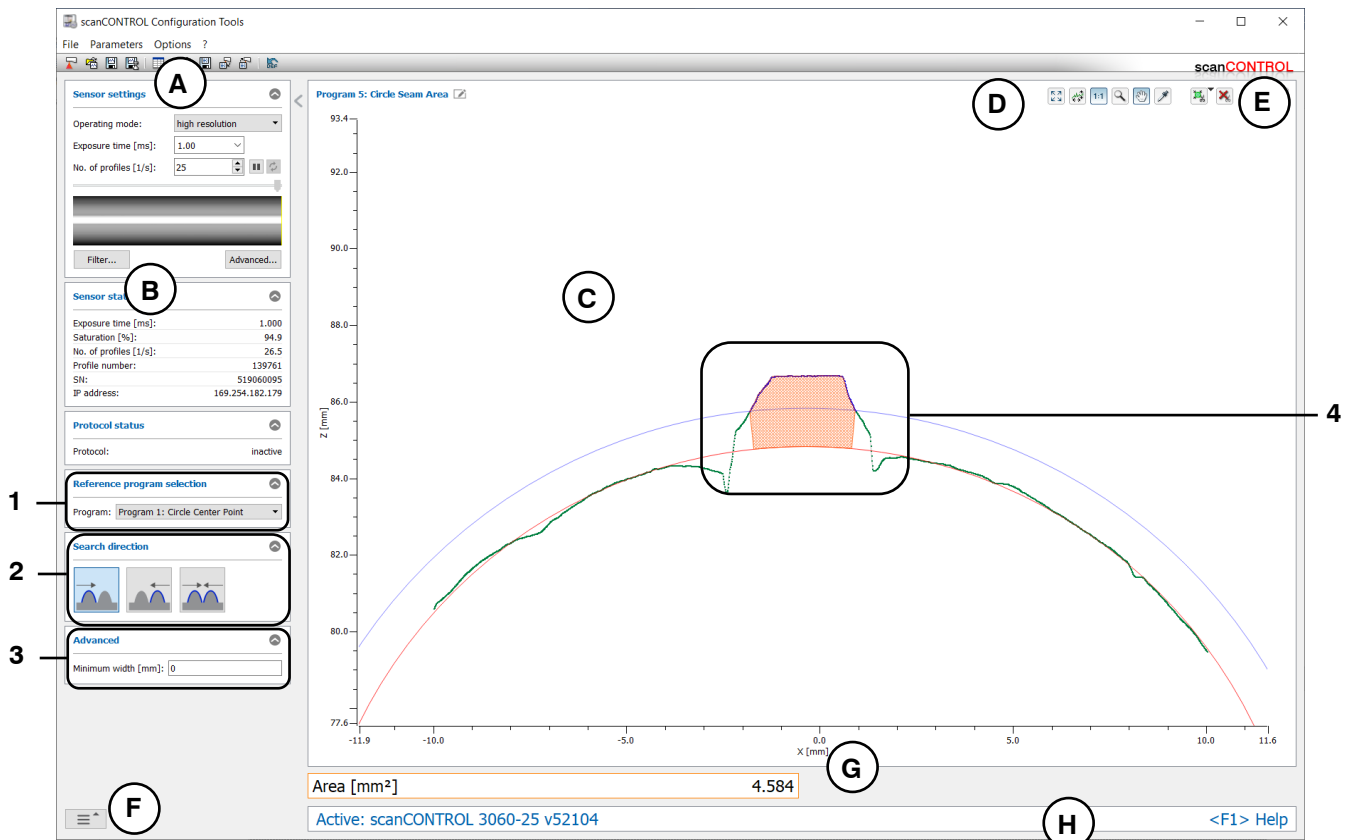


Fig. 4.49: "Circle Seam Area" measuring program

Display elements and parameters in the "Circle Seam Area" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the heightening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width:** Enter the minimum width of the heightening.
 - 4 Display of the area:** In the 2D-display, the area determined by the measuring program is displayed hatched.

4.10 "Circle Groove" Group

Programs for inspecting deepenings, for example of a groove on circular profile sections, can be found in the "Circle Groove" group.

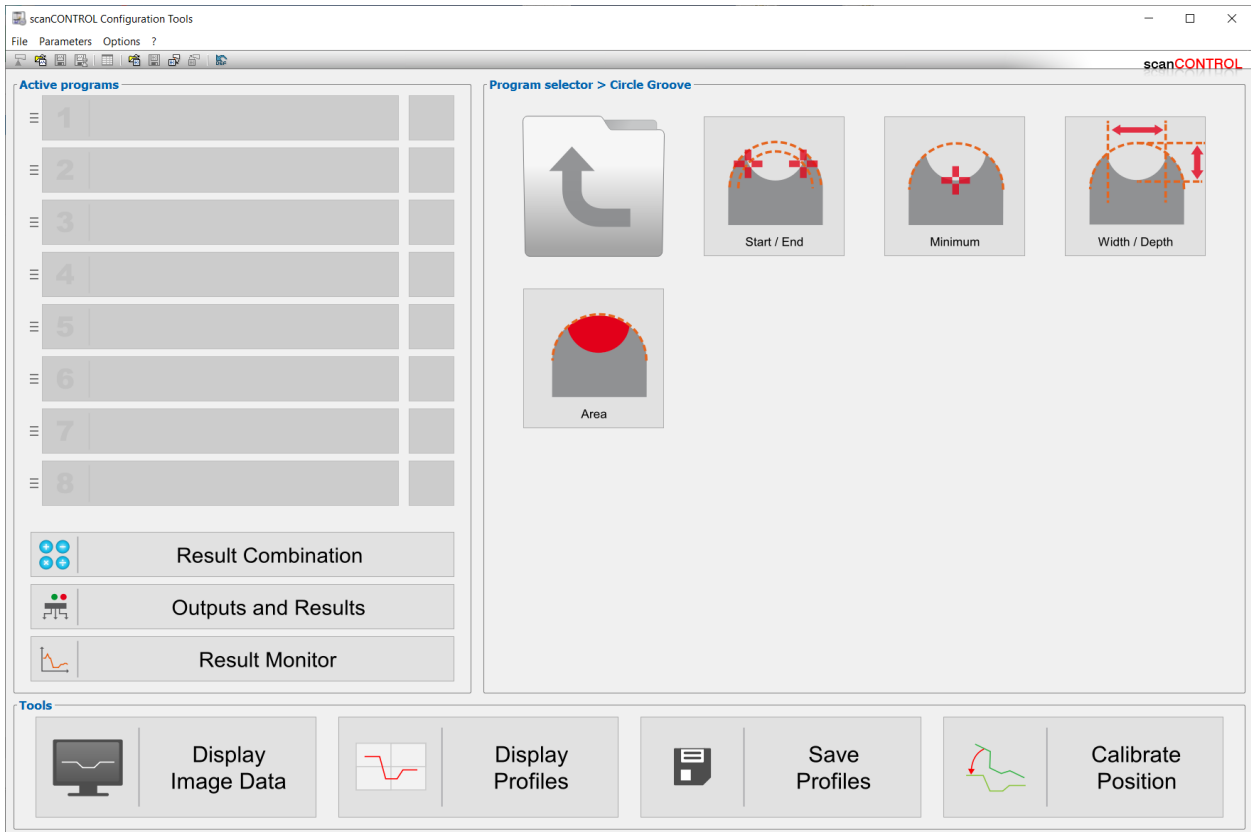


Fig. 4.50: "Circle Groove" group







Measuring programs in the "Circle Groove" group:

- Circle Start/End: Determination of a deepening and calculation of the X coordinates of the start and end point.
- Circle Minimum: Determination of a deepening and calculation of the coordinates of the point with maximum depth.
- Circle Width/Depth: Determination of a deepening and calculation of its width and depth.
- Circle Area: Determination of a deepening and calculation of its area.

4.10.1 "Circle Groove Start/End" Measuring Program

Use the "Circle Groove Start/End" measuring program to determine the start and end point of a significant deepening on circular profile sections. For example, such a deepening can be a groove. The program uses a reference circle from the selected predecessor measuring program. A minimum depth relative to the reference circle is specified (so-called threshold circle). A deepening is detected for existing profile points inside the reference circle. The measuring program then determines the start and the end point of the deepening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the deepening (see Fig. 4.45):
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening. The width of the deepening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Start X [mm]:** The X coordinate of the start point of the deepening.
- **End X [mm]:** The X coordinate of the end point of the deepening.

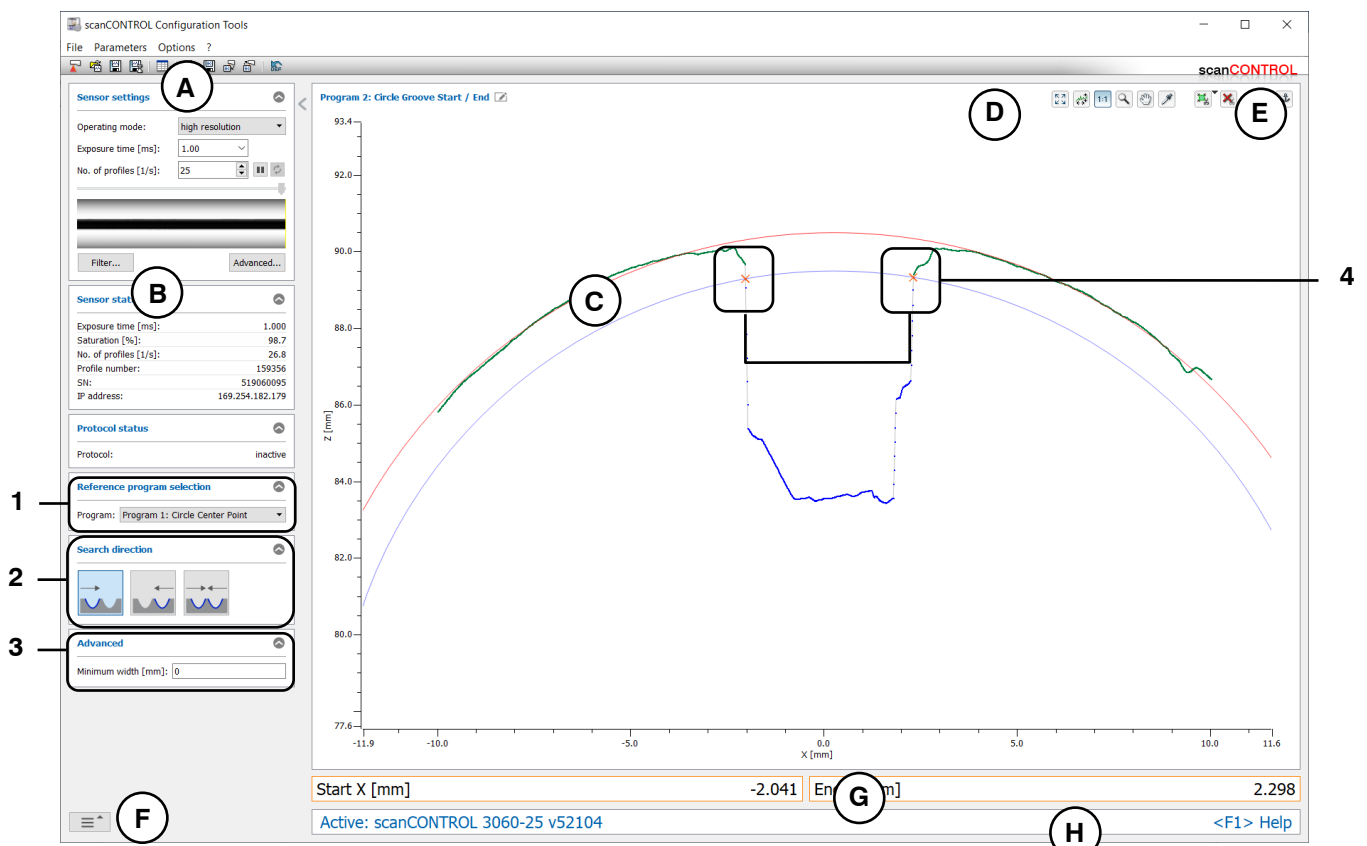


Fig. 4.51: "Circle Groove Start/End" measuring program







Display elements and parameters in the "Circle Groove Start/End" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width [mm]:** Enter the minimum width of the deepening.
 - 4 Display of the start and end point:** In the 2D-display, the start and end point determined by the measuring program are each represented by an orange cross.

4.10.2 "Circle Groove Minimum" Measuring Program

Use the "Circle Groove Minimum" measuring program to determine the minimum point of a significant deepening on circular profile sections. For example, such a deepening can be a groove. The program uses a reference circle from the selected predecessor measuring program. A minimum depth relative to the reference circle is specified (so-called threshold circle). A deepening is detected for existing profile points inside the reference circle and the measuring program then determines the point with maximum distance from the reference circle.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the deepening (see Fig. 4.45):
 - The deepening is searched from left .
 - The deepening is searched from right .
 - The deepening is searched from left and right .
- Enter the minimum width of the deepening. The width of the deepening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Minimum X [mm]:** The X coordinate of the minimum point of the deepening.
- **Minimum Z [mm]:** The Z coordinate of the minimum point of the deepening.

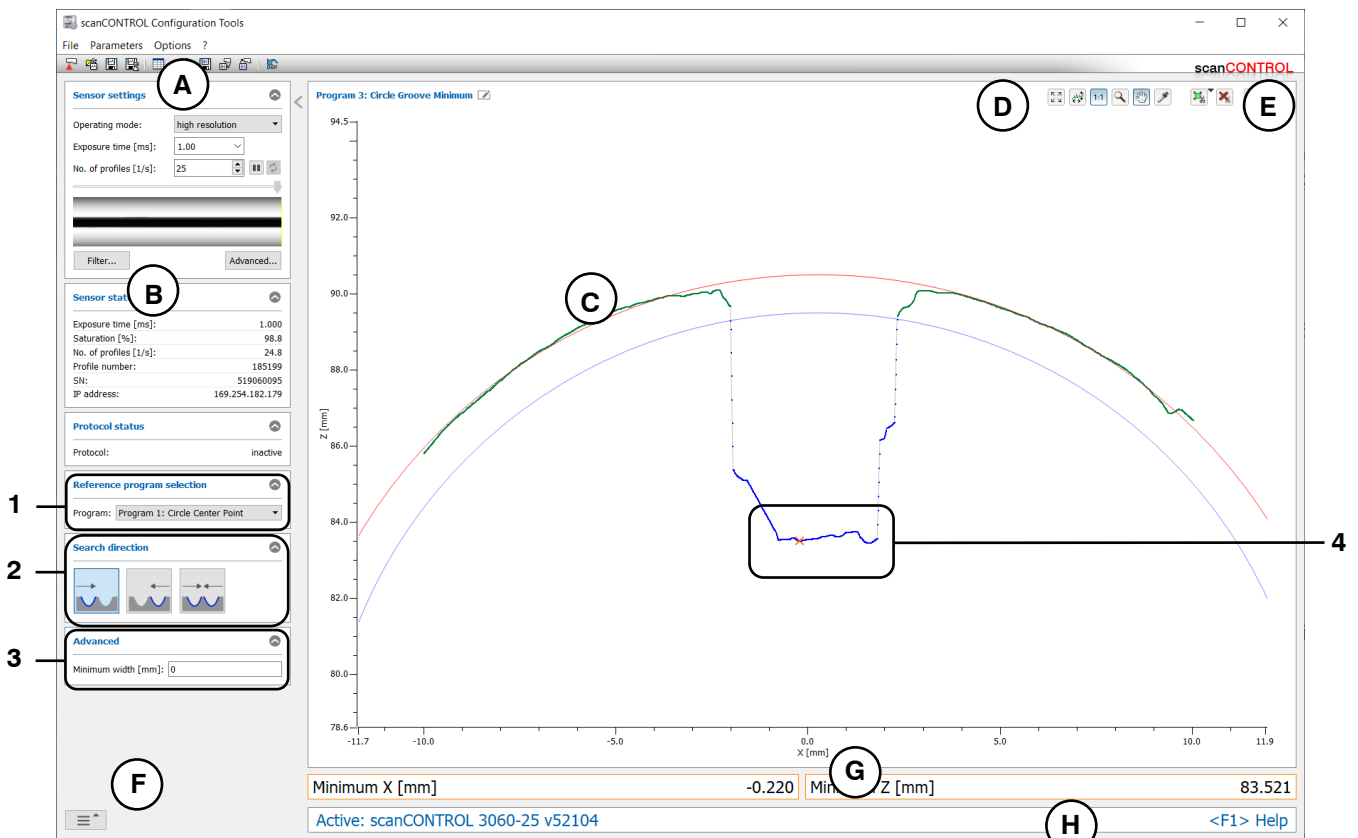


Fig. 4.52: "Circle Groove Minimum" measuring program







Display elements and parameters in the "Circle Groove Minimum" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width:** Enter the minimum width of the deepening.
 - 4 Display of the minimum point:** In the 2D-display, the minimum point determined by the measuring program is represented by an orange cross.

4.10.3 "Circle Groove Width/Depth" Measuring Program

Use the "Circle Groove Width/Depth" measuring program to determine the width and depth of a significant deepening on circular profile sections. For example, such a deepening can be a groove. The program uses a reference circle from the selected predecessor measuring program. A minimum depth relative to the reference circle is specified (so-called threshold circle). A deepening is detected for existing profile points inside the reference circle. The measuring program then determines the width and depth of the deepening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the deepening (see Fig. 4.45):
 - The deepening is searched from left 
 - The deepening is searched from right 
 - The deepening is searched from left and right 
- Enter the minimum width of the deepening. The width of the deepening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured values:

- **Width [mm]:** The width of the deepening.
- **Depth [mm]:** The depth of the deepening.

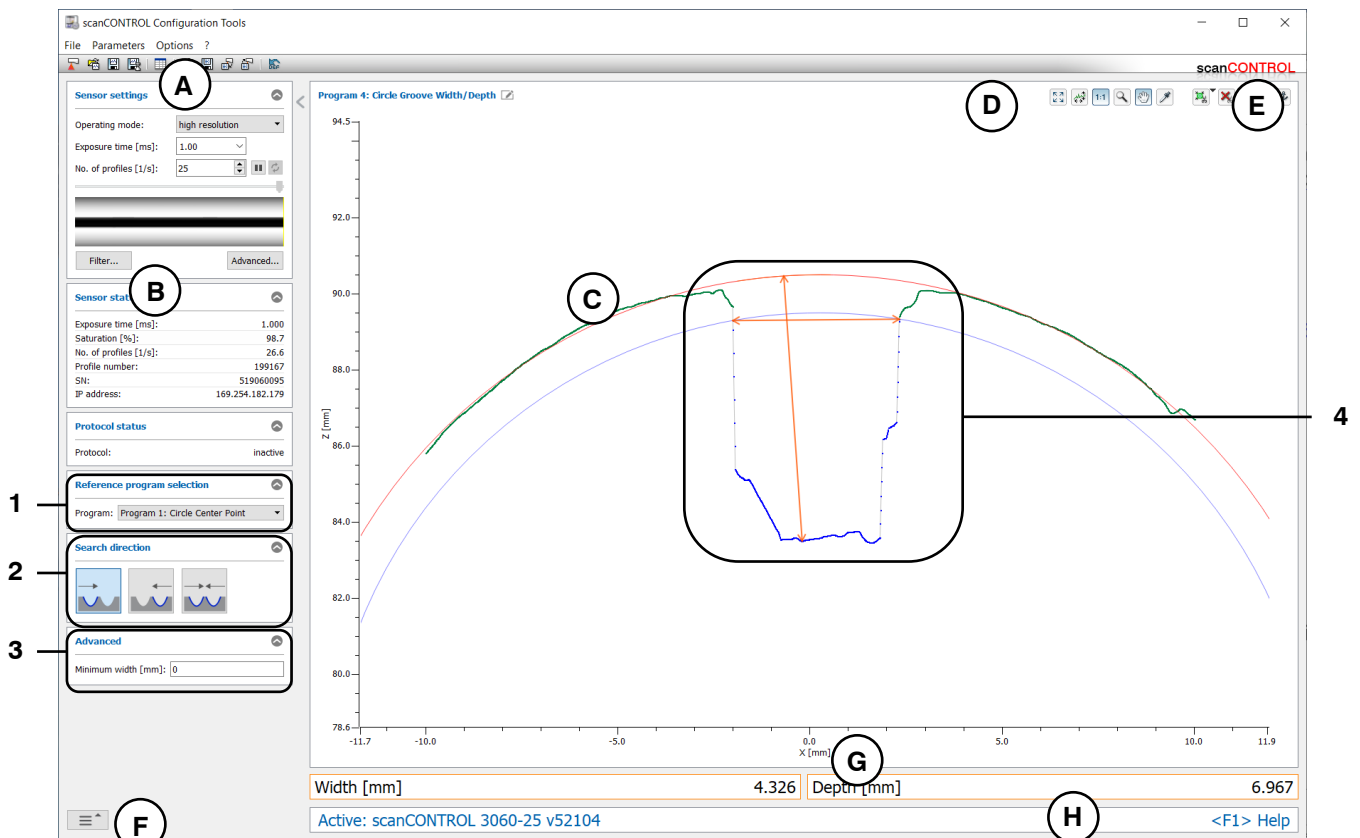


Fig. 4.53: "Circle Groove Width/Depth" measuring program







Display elements and parameters in the "Circle Groove Width/Depth" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width [mm]:** Enter the minimum width of the deepening.
 - 4 Display of the width and depth:** In the 2D-display, the width and depth determined by the measuring program are each represented by an orange arrow.

4.10.4 "Circle Groove Area" Measuring Program

Use the "Circle Groove Area" measuring program to determine the area of a significant deepening on circular profile sections. For example, such a deepening can be a groove. The program uses a reference circle from the selected predecessor measuring program. A minimum depth relative to the reference circle is specified (so-called threshold circle). A deepening is detected for existing profile points inside the reference circle and the measuring program then determines the area of the deepening.

Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7).
- Add any circle measuring program as predecessor to the active programs (see Chapter 4.8).
- Parameterize the added circle program (see Chapter 4.8).
- Select a circle measuring program from the list of reference programs.
- Define the search direction for the detection of the deepening (see Fig. 4.45):
 - The deepening is searched from left 
 - The deepening is searched from right 
 - The deepening is searched from left and right 
- Enter the minimum width of the deepening. The width of the deepening is defined by the length of the secant by the two end points of the circular profile section of the threshold circle.
- If necessary, limit the measuring range in order to eliminate interfering points ( see Chapter 3.13.2).
- Define the minimum depth for the detection of the deepening ( see Chapter 3.13.5).
- If necessary, activate the dynamic tracking for the measuring range, for the ranges for the detection of the deepening ( see Chapter 3.13.6).

The measuring program outputs the following measured value:

- **Area [mm²]:** The area of the deepening.

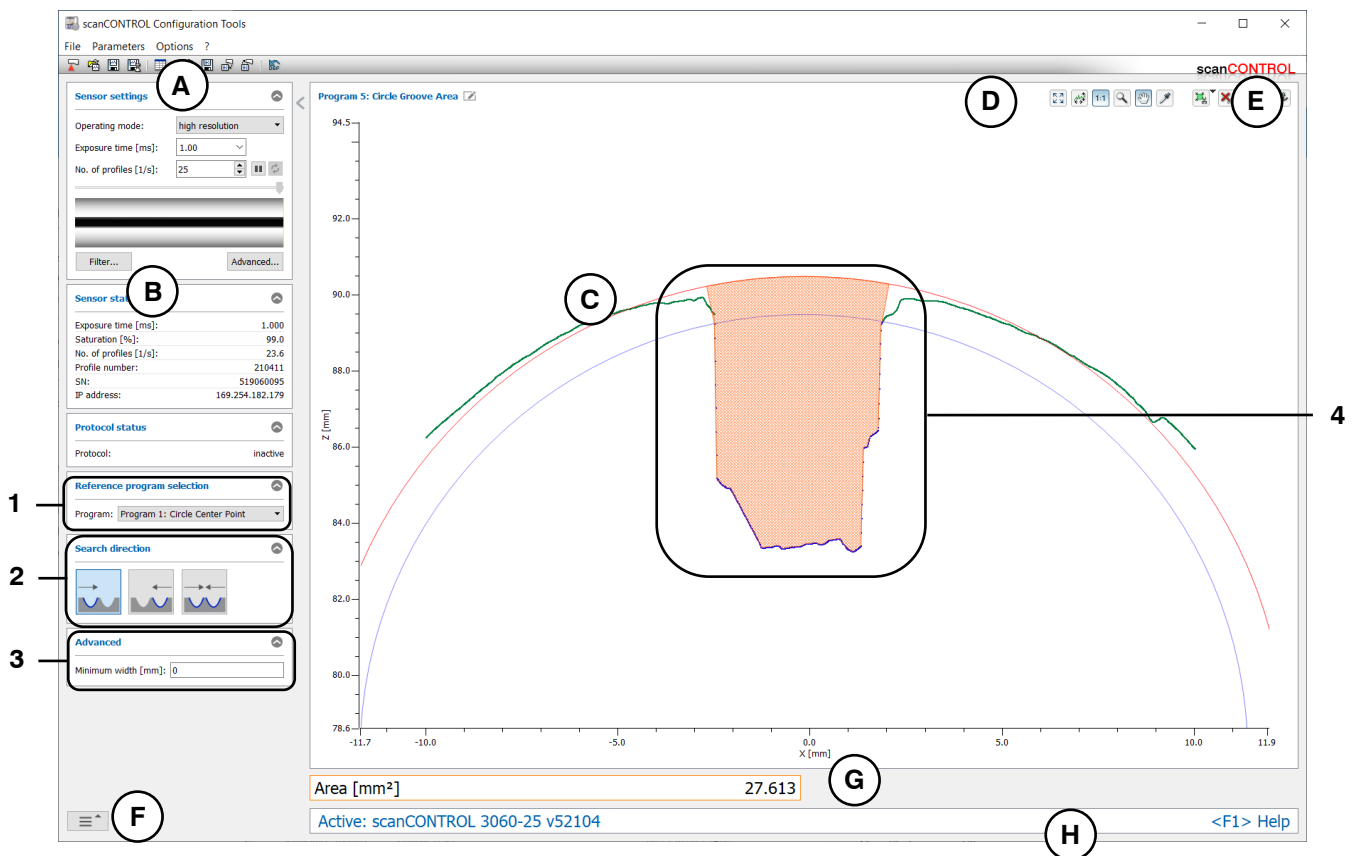


Fig. 4.54: "Circle Groove Area" measuring program

Display elements and parameters in the "Circle Groove Area" measuring program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
 - B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
 - C 2D-display:** This display shows the last measured profile, the measuring ranges and measurement results.
 - D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
 - E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
 - F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
 - G Results display:** The results of the current valid measurement are displayed.
 - H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
-
- 1 Reference program selection:** Select a reference measuring program (see above).
 - 2 Search direction:** Select the search direction for the detection of the deepening (see above) in this input field.
 - 3 Advanced settings:**
 - **Minimum width:** Enter the minimum width of the deepening.
 - 4 Display of the area:** In the 2D-display, the area determined by the measuring program is displayed hatched.

4.11 "Tools" Group

In the bottom area of the main view you will find the "Tools" group which provides useful utilities.

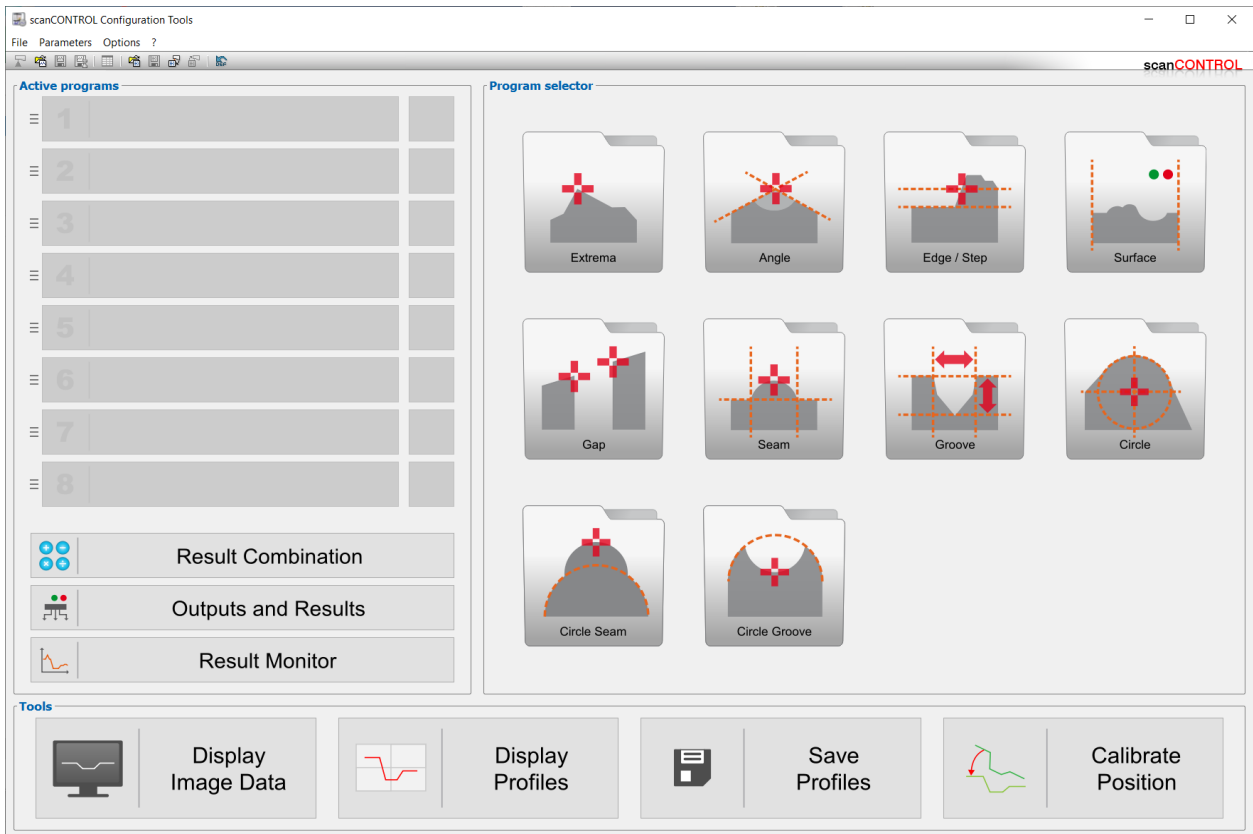


Fig. 4.55: "Tools" group

Programs in the "Tools" group:

- Display Image Data: Visualization of the image data recorded by the sensor matrix.
- Display Profiles: Display of the profile data.
- Save Profiles: Save profile sequences for later offline analysis.
- Calibrate Position: Adjusting the mounting position of the measurement system.

4.11.1 "Display Image Data" Program

The original signal recorded on the sensor matrix of scanCONTROL is displayed using the "Display Image Data" program. This program is useful for detecting and eliminating sources of errors and interference, such as overexposure or multiple reflections.

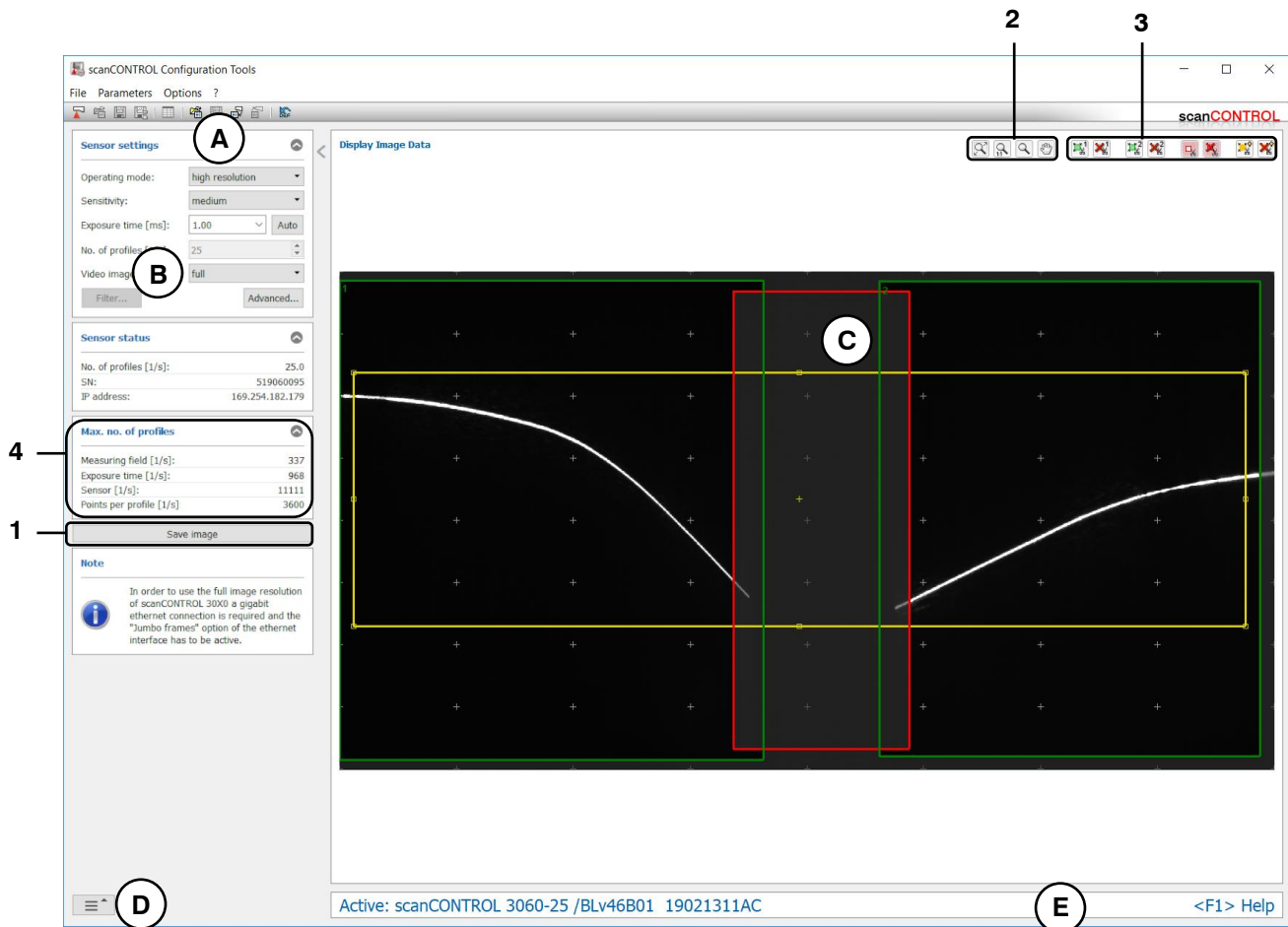


Fig. 4.56: "Display Image Data" program

Display elements and parameters in the "Display Image Data" program:

- A "General" toolbar:** Using this toolbar, you can load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values. Detail information about each parameter can be found in the Chapter 3.7 "Scanner settings". Only a part of the scanner settings is available in the "Display image data" measuring program. The following parameters are only available in this measurement program:
- **Sensitivity:** Use this value to define the sensitivity of the sensor (see Chapter 3.9 "General" tab sheet section 3).
 - **Auto:** Assumes the automatic exposure time determined by the scanCONTROL measurement system (see Chapter 3.9 "General" tab sheet section 4 and "Measuring field" tab sheet section 4).

Note: The functionality is only available in "Display Image Data" program and if the "internal" option is selected for the "Trigger mode" parameter (see Chapter 3.9 "Interface" tab sheet section 5).

- **Video image resolution:** Change the resolution of the sensor matrix image (scanCONTROL 30XX):
 - **full:** The image of the sensor matrix is transmitted in full resolution.
 - **reduced:** The image of the sensor matrix is transmitted in reduced resolution. This setting can be used if the bandwidth of the ethernet connection is insufficient for the full resolution.

Note: In order to use the full image resolution of scanCONTROL 30XX a gigabit ethernet connection is required and the "Jumbo frames" option of the ethernet interface has to be active.

- C 2D-display:** This display shows the just recorded image of the sensor matrix. The measuring and reference fields (see Chapter 3.9) are shown on the display as rectangles.
- D Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- E Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Save image:** This saves the just recorded image of the sensor matrix to a file. A standard Windows dialog is displayed for selection of the path and file name for saving the image. The image is saved in "png" file format using the ".png" file extension.
- 2 "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17)
- 3 "Measuring" toolbar:** Use the toolbar to set the measuring and reference fields with the mouse and to reset it (see Chapter 3.9, "Measuring field" tab).
- 4 Max. no. of profiles**
- **Measuring field [1/s]:** The maximum profile frequency resulting from the setting of the "Measuring field" parameter.
 - **Exposure time [1/s]:** The maximum profile frequency resulting from the setting of the "Exposure time" parameter.
 - **Sensor[1/s]:** The maximum profile frequency resulting from the sensor hardware.
 - **Points per profile [1/s]:** The maximum profile frequency resulting from the setting of the "Points per profile" parameter (scanCONTROL 30XX).

Note: It is not possible in the "Display image data" program to save parameters to file and permanently on scanCONTROL.

4.11.2 "Display Profiles" Program

Use the "Display Profiles" program to display profiles.

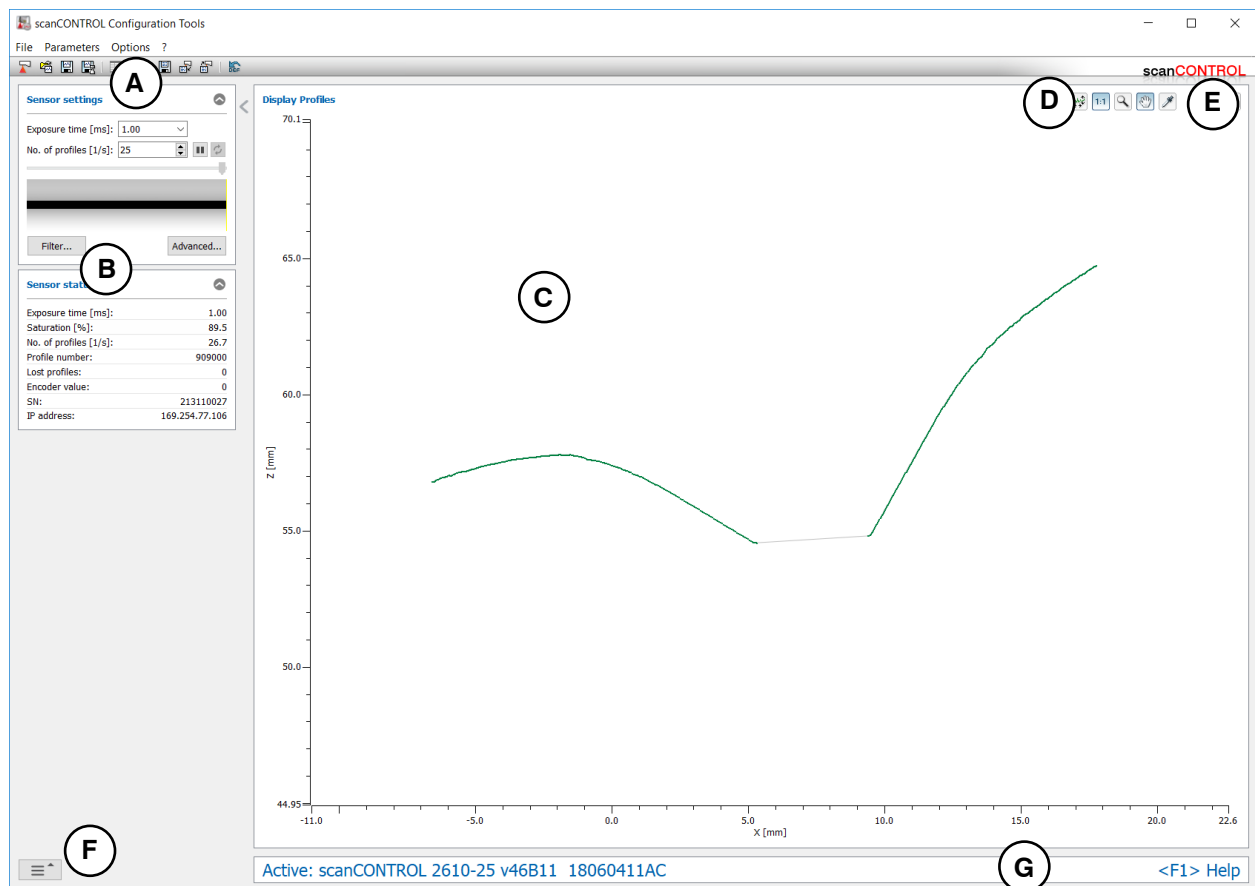


Fig. 4.57: "Display Profiles" program

Display elements and parameters in the "Display Profiles" program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

4.11.3 "Save Profiles" Program

You create recordings of profile sequences with the "Save Profiles" program. Configuration Tools creates a file which can later be loaded into any measuring program. Use this function to save profile sequences with a high scan rate. In doing so, the profiles are first buffered in the RAM of the PC and then saved in a file.

Note: It is also possible in the measuring programs described above to save profile sequences ("General" toolbar). However, only low scan rates are possible there as the data are written to the file immediately.

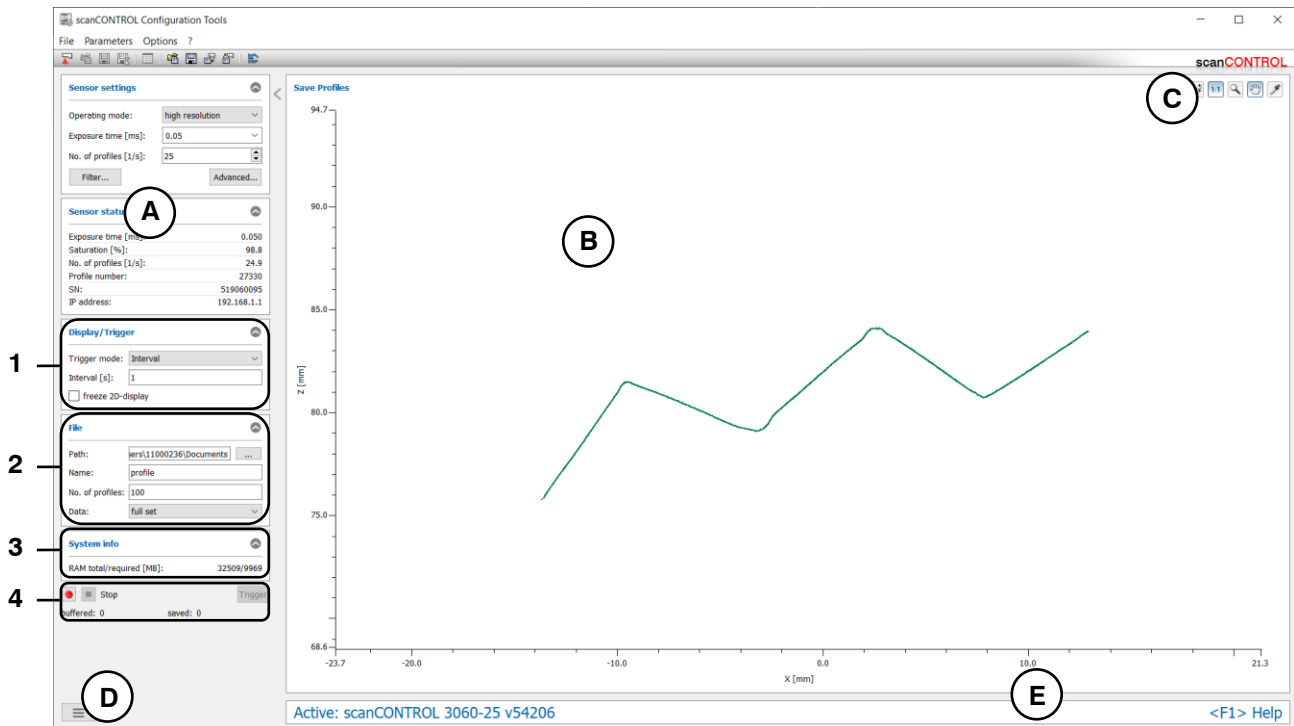


Fig. 4.58: "Save Profiles" program

Display elements and parameters in the "Save Profiles" program:

A Scanner settings: Change the settings of scanCONTROL with these values (see Chapter 3.7).

B 2D-display: This display shows the last measured profile.

C "Display" toolbar: Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).

D Navigation menu: Click on this button in order to show the navigation menu (see Chapter 3.19).

E Status line: Status and error messages are displayed on the status line (see Chapter 9.1).

1 Display/Trigger

- **Trigger mode:** Select the trigger mode for buffering the profiles (see below, section "Record"):
 - **internal:** Each profile supplied by the connected sensor is buffered.
 - **manual:** Buffering of the individual profiles is triggered with the "Trigger" button (see Fig. 4.58, section 4).
 - **interval:** Buffering of the last profile supplied is triggered automatically at a time interval.
- **Interval [s]:** The time interval between the buffered profiles (0.04 - 10000 sec.).
- **Freeze 2D-display:** Deactivates the 2D-display. When the display is deactivated, the performance of the system is better and profiles can be saved with a higher scan rate. This option is automatically deactivated when the measuring program is started.

2 File

- **Path:** The directory in which the file is stored.
- **Name:** Input the name for the profile sequence to be saved here.
- **No. of profiles:** Maximum number of profiles which should be saved in the file. This number should not be selected higher than necessary as the reserved part of the RAM for the profiles is dependent on it. The upper limit for this parameter depends on the number of points per profile (see Chapter 3.9).
- **Data:** Using this input field, select which information is saved in the profile file. This setting is crucial for the resulting file size of the profile file and the maximum possible scan rate.
 - **x/z only:** The X and Z coordinates of the individual measuring points will be saved. This setting minimizes the file size.
 - **x/z + data:** The information of the selected reflection is saved (X/Z coordinates, width, maximum, threshold and moment 0th order).
 - **full set:** All four reflections, the timestamp and the scanCONTROL settings are saved. This setting results in an enlarged file and lower maximum possible scan rate, however it is recommended as no information is lost with this setting.

Note: When using the format "x/z only" and "x/z + data", boundary points of the profile may be lost under certain circumstances ("x/z only": a maximum of four points may be lost, "x/z + data ": a maximum of one point may be lost).

3 System info

- **RAM total/required:** Two values are displayed. The first value indicates the size of the physical RAM of your system. The second value indicates the size of the memory which is necessary for saving the profile sequences. This value depends, among other things, on the settings of the parameters "No. of profiles" (File/Buffer) and "Points per profile" (Advanced scanner settings). If the value of used memory exceeds the available memory, the system may accept user inputs only very slowly and error-free behavior is no longer guaranteed.

4 Record

- Start the recording of the profile sequences with the red "Record" button. The profiles are now buffered in the selected trigger mode (see above, section "Trigger mode") in the RAM. The program shows you the status of this process in the field "buffered: [profile number]". If the maximum number of profiles is reached, the profiles are saved in the selected file. The buffering can be ended prematurely and the saving started by pressing the "Stop" button. The time required for the operation varies according to the size of the profile sequence. The program shows you the status of this process in the field "saved: [profile number]". The saving process may be ended prematurely by pressing the "Stop" button.

Note: It is not possible in the "Save profile" program to load profile sequences and to log measured values.

Note: In order to save the scanCONTROL settings in the profile file, select "full set" for the "standard" data format or "x / z + data" for the compressed data format (see Chapter 3.9, "Advanced" tab, section 1).

Note: There may be a discrepancy between the setpoint value and the actual value for the scan rate used for saving if the number of scans is set too high or the processing power of the PC is insufficient.

4.11.4 "Calibrate Position" Program

Use the "Calibrate Position" program in order to adjust tilting and displacements which are caused by the mounting position of the measurement system. You may rotate and translate the profile data and store the resulting transformation permanently on the scanCONTROL measurement system or transfer to a loaded profile sequence and save it again. Proceed as follows:

- Configure the scanCONTROL measurement system ("Scanner settings", see Chapter 3.7) or load a previously saved profile sequence (see Chapter 3.5).
- If necessary, limit the measuring range in order to eliminate interfering points (see Chapter 3.13.2).
- If necessary, define an algorithm and a range in which a line should be fitted to the profile points (see Chapter 3.13.4). The current angle and offset of the fitted line will be shown in the results display and will make the setting of the rotation angle and the translation offset easier for you.
- Use the "Rotation angle" and "Translation X/Z" input fields in order to rotate and translate the profile (Transformation). The 2D-display shows the current and the transformed profile. The results display shows the angle and offset of the current and the transformed fitted lines.
- Use the "Calibrate scanCONTROL" or "Save calibrated profiles" button in order to store the transformation permanently on scanCONTROL or to transfer the transformation to the loaded profile sequence and save it again. The original profile will disappear and only the transformed profile and the transformed angle and offset will be displayed. The "Calibrate scanCONTROL" button will be replaced by the "Reset calibration" button. The status line will show the hint "Calibration active".

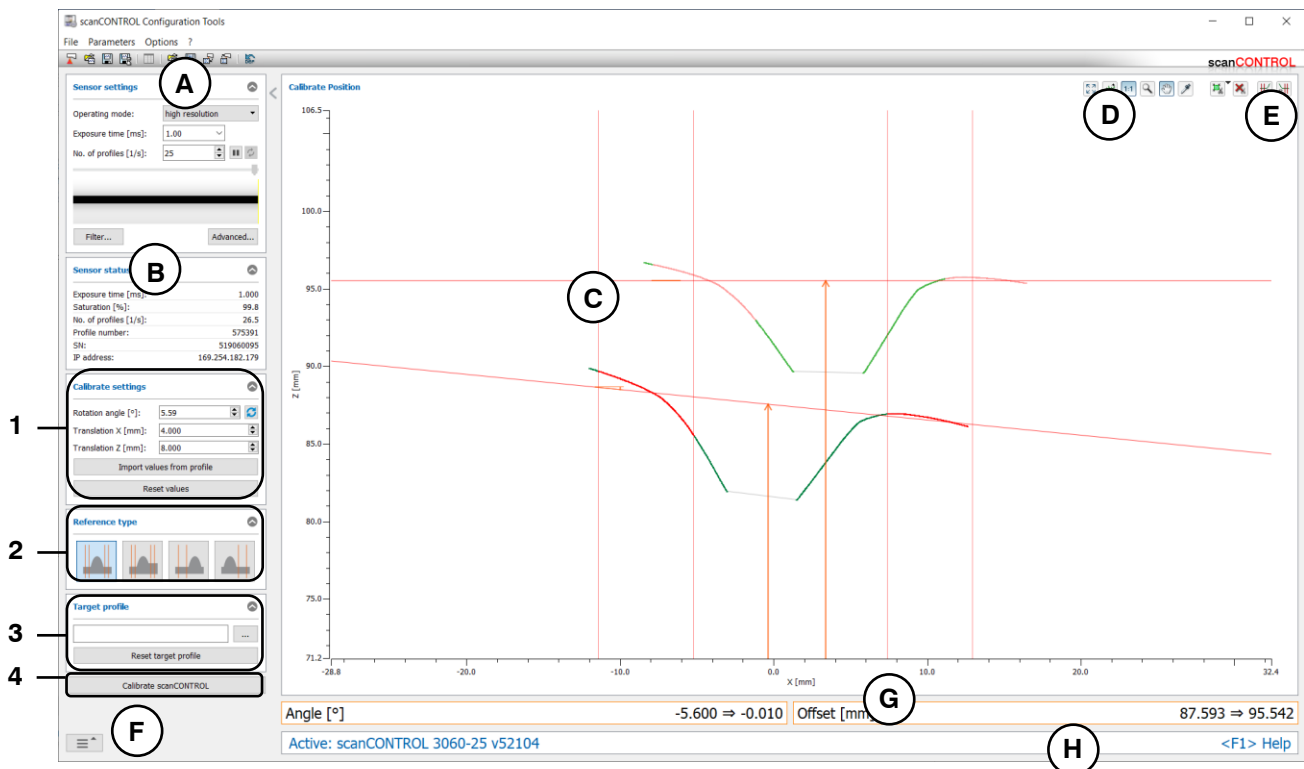



Fig. 4.59: "Calibrate Position" program

Display elements and parameters in the "Calibrate Position" program:

- A "General" toolbar:** Using this toolbar, you can load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G Results display:** The results of the current and of the transformed profile are displayed.
- H Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).
- 1 Transformation settings:**
- **Rotation angle [°]:** The angle by which the profile is rotated. The center of the measurement range is used as center of rotation. Use the  button to automatically adjust the angle value so that the measured angle equals zero.
 - **Translation X [mm]:** The offset by which the profile is translated in X direction.
 - **Translation Z [mm]:** The offset by which the profile is translated in Z direction.
 - **Import values from profile:** Reads the transformation data from a stored profile sequence.
 - **Reset values:** Resets the "Rotation angle" and "Translation X/Z" values to zero.
- 2 Reference type:**
- **left and right:** The reference line is fitted to the profile points in the left and right reference ranges.
 - **left and right step:** The reference line is fitted to the profile points in the left and right reference ranges. The directional vector of both reference lines is calculated from the points in both ranges. The offsets of the reference lines are calculated from the points in each of the ranges.
 - **left:** The reference line is fitted to the profile points in the left reference range.
 - **right:** The reference line is fitted to the profile points in the right reference range.
- 3 Target profile:** You can overlay a saved profile for better orientation in the profile display.
- ...: Select a saved profile, which is displayed as target profile.
 - **Reset target profile:** Remove the target profile.
- 4**
- **Calibrate scanCONTROL:** Stores the transformation permanently on the scanCONTROL measurement system.
 - **Save calibrated profiles:** Saves the transformed profiles in offline mode.

Note: When saving an offline profile sequence, the subsequently changed filter settings (see Chapter 3.10) are not taken into account. However, the inversion settings (see Chapter 3.10) will be adopted.

- **Reset calibration:** Deletes the stored transformation from the scanCONTROL measurement system.

Note: In order to adjust the transformation or to store a new transformation on the scanCONTROL measurement system, initially use the "Reset calibration" button (online mode) (see Fig. 4.60) in order to clear the current transformation. To save a transformed profile sequence in offline mode, use the "Save calibrated profiles" button (see Fig. 4.60).

Note: The transformation is performed as follows: At first the rotation through the center of the measurement range is performed, and then the translation of the profile is performed.

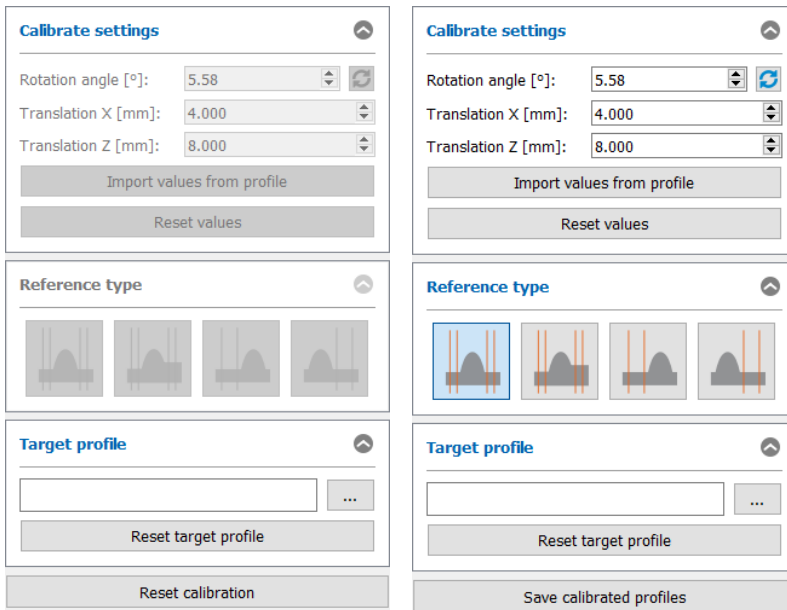


Fig. 4.60: "Reset calibration" (online mode) and "Save calibrated profiles" (offline mode) button

4.12 "Export Profiles" Program

Use the "Export Profiles" program to save profiles in an Excel-compatible format. The profiles are saved as ".slk" files. Use the "File → Export profiles" menu entry in order to start the "Export Profiles" program.

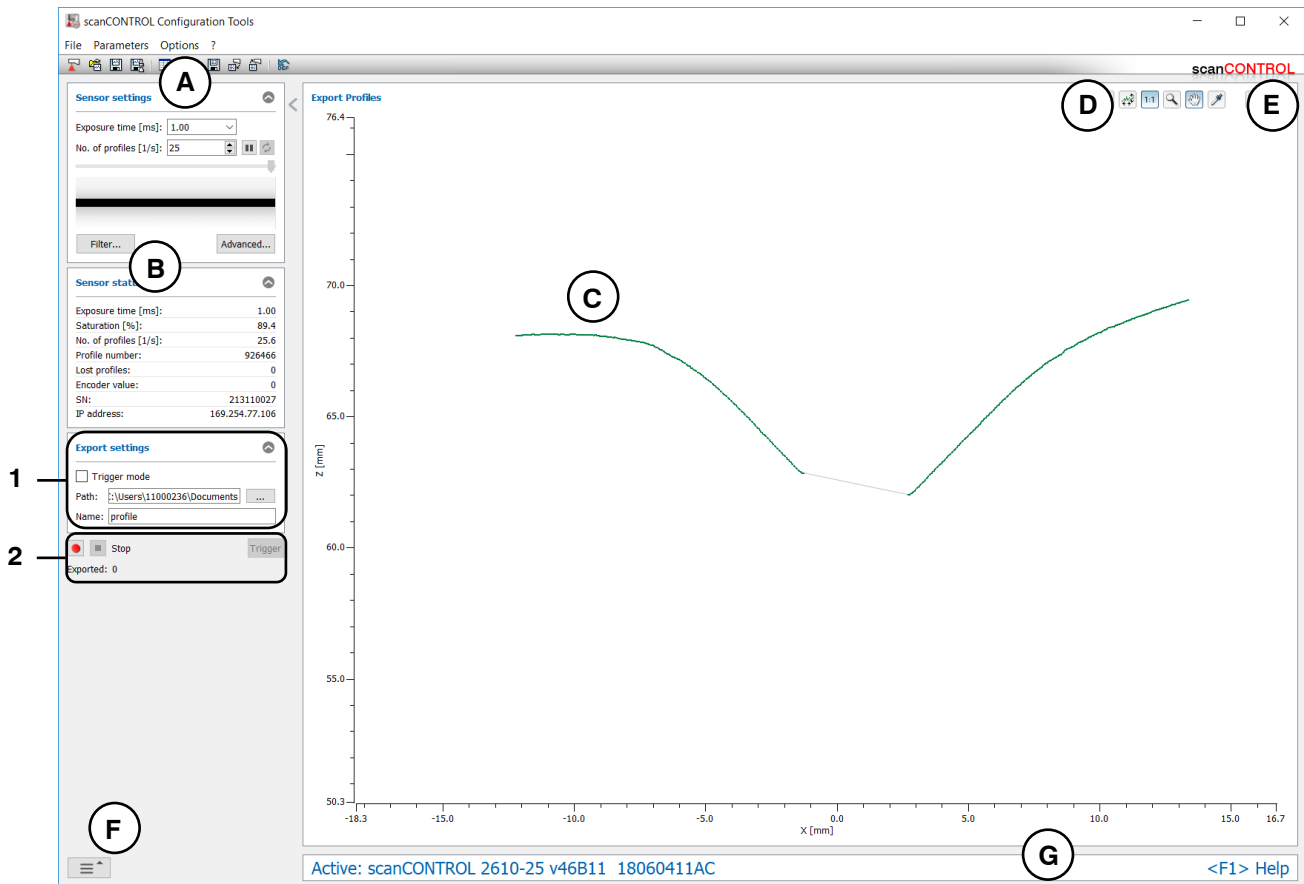


Fig. 4.61: "Export Profiles" program

Display elements and parameters in the "Export Profiles" program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), load parameters (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E "Measurement" toolbar:** Set the various search ranges and limits for the measurement using this toolbar (see Chapter 3.18).
- F Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- G Status line:** Status and error messages are displayed on the status line (see Chapter 9.1).

1 Export settings

- **Trigger mode:** You activate the trigger mode (see below, "Record" section) with this input field.
- **Path:** The directory in which the files are stored.
- **Name:** The name of the profile files which the profile data are exported to.

2 Record

- **Trigger mode, inactive:** Start the recording of the profile sequences with the red "Record" button. The transferred profiles are exported now. The process can be finished by pressing the "Stop" button.
- **Trigger mode, active:** Press the red "Record" button. The measuring program is now ready to export profiles. Press the "Trigger" button in order to export individual profiles. The process can be finished by pressing the "Stop" button.

Note: The program stores the profiles as ".slk" files. This format can be imported into other programs, for example Microsoft Excel. One profile is stored in each file whereby the file names are automatically incremented. For example, if the profile name is specified as "profile", the files "profile_00001.slk", "profile_00002.slk" etc. are created. The profile counter is reset after 99999 profiles.

Note: Only profile points being inside the region of interest (Cutting out, see Chapter [3.13.2](#)) are stored.

5. Combining Results from Measuring Programs

After completing the configuration of the individual measuring programs, use the "Result Combination" view to combine the results defined in the measuring programs. You can define up to eight signals for combination purposes. For each signal, choose up to two results from the active measuring programs or already combined results and the algorithm for calculation. In addition, you may add a constant value to each signal defined this way, determine the absolute value and negate the result.

Use the "Result Combination" button in the main view (see Chapter 3.2) or the navigation menu (see Chapter 3.19) in order to access the "Result Combination" view. This view first displays all the signals defined for calculation, along with the corresponding results:

combined signals	
Perpendicular point X[mm]/Z[mm]:	4.779 / 62.798
Distance euclidean [mm]:	10.986
Center point X[mm]/Z[mm]:	2.180 / 67.637
Distance X [mm]:	-5.219
Distance Z [mm]:	11.442
Signal 6	
Signal 7	
Signal 8	

Fig. 5.1: "Result Combination" view - summary

Display elements and parameters in the "Result Combination" view:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save parameters to a file and load parameters from a file (see Chapter 3.14), store parameters permanently on scanCONTROL and load parameters from scanCONTROL (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile and measurement results.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- F Status line:** Status and error messages are displayed on the status line. If errors occur in several active measuring programs, the first error found is displayed in the order of the measuring programs (see Chapter 9.1).

- 1 **Combined signals (setting):** In this field, you can enable the editing of any signals that have already been defined or add new signals in order to combine measured values or change the order of the combined signals using "drag & drop". You also may choose to show or hide the combined signals in the 2D-display using the "symbolic eye" buttons.
- 2 **Combined signals (overview):** Shows the signals combined and the associated results from the currently valid measurement.
- 3 **Display of the measurement results:** The signals combined (orange) and their operands (grey) are shown in the 2D display.

Use the "Combined signals" input field (see 1, Fig. 5.1), to define signals for calculation. Press the button of a previously defined signal, or add a new signal. In the "Result Combination" view, appropriate input fields are enabled:

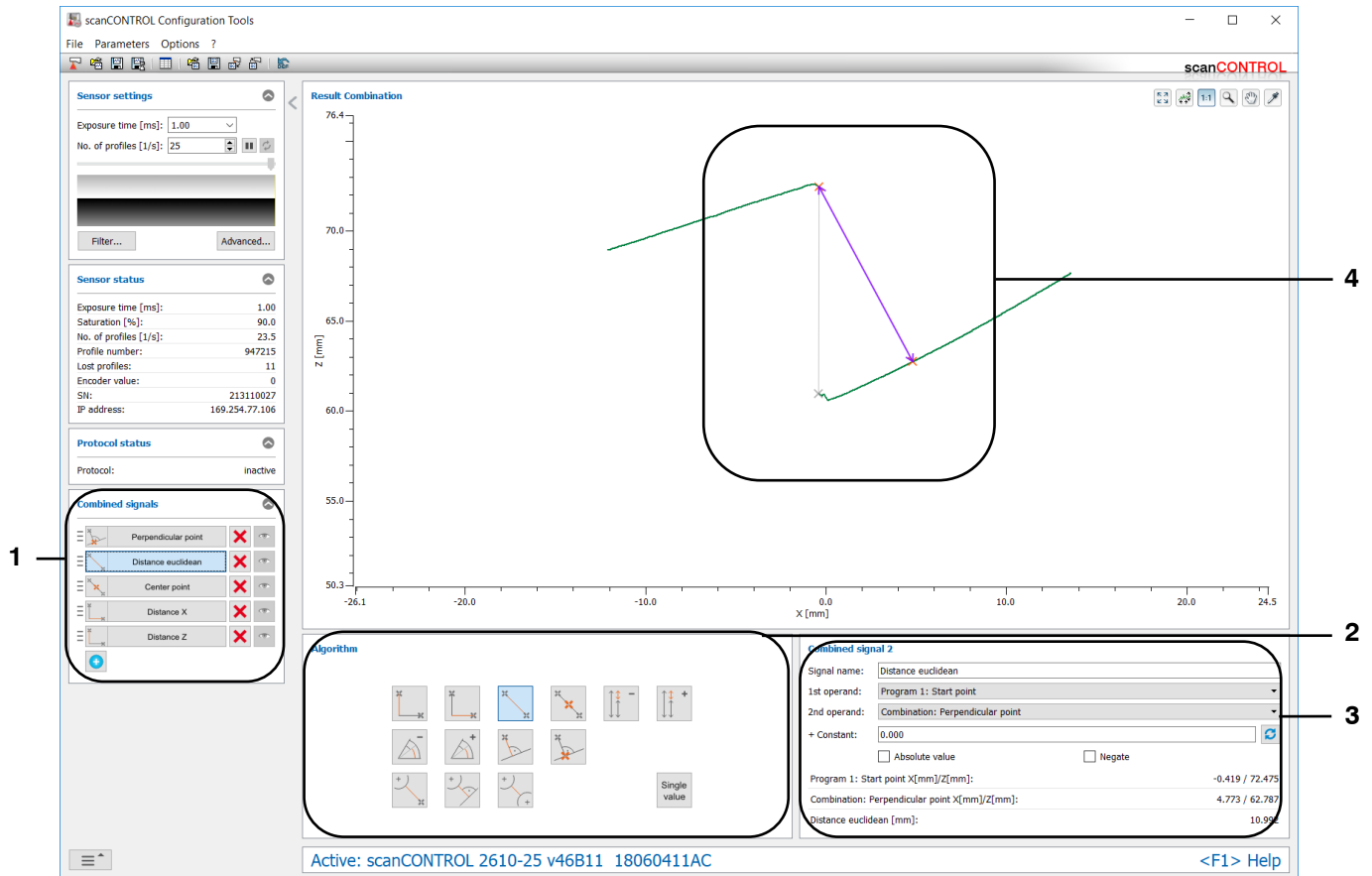


Fig. 5.2: "Result Combination" view - defining signals for calculation

Display elements and parameters in "Result Combination" view:

- 1 **Combined signals (setting):** In this field, activate the editing of any signals that have already been defined or add new signals to be combined using measured values. You also may choose to show or hide the respective signals in the 2D-display using the "symbolic eye" buttons. In addition, you have the option of removing active signals. The selected signal is highlighted in blue.
- 2 **Algorithm:** In this field, select the algorithm for calculating the measured values (see Chapter 5.1). The button of the selected algorithm is highlighted in blue.
- 3 **Combined signal x:** In this field, enter the name for the selected signal x (x = 1 ... 8) and select the measured values (operands), which are used for calculation. If necessary, specify a constant which is added to the result of the calculation (see Chapter 5.2). You may determine the absolute value and negate the result.
- 4 **Display of the measurement results:** In the 2D display the result of the calculation is shown (in purple), as well as the selected operands (orange) and other possible operands (grey).

To return to the overview after defining a combined signal and to display all the signals, press on the active signal (blue) in the "Combined signals" input field (see Fig. 5.2).

5.1 Algorithms available for the Combination of Measured Values

The following algorithms are available for combining measured values:



Distance Z: Calculates the difference of the Z coordinates of two points.



Distance X: Calculates the difference of the X coordinates of two points.



Distance euclidean: Calculates the euclidean distance between two points.



Center of gravity: Calculates the center of gravity of two points.



Difference of distances: Calculates the difference between two distances.



Sum of distances: Calculates the sum of two distances.



Difference of angles: Calculates the difference between two angles.



Sum of angles: Calculates the sum of two angles.



Distance point to line: Calculates the shortest distance from a point to a line.



Perpendicular point: Calculates the foot point of a dropped perpendicular to a straight line at a point.



Distance circle to point: Calculates the shortest distance from a circle to a point.



Distance circle to line: Calculates the shortest distance from a circle to a line.



Distance circle to circle: Calculates the shortest distance from a circle to a circle.



Single value: You can select a measured value from the active measuring programs. It is used for the addition of constants to measured values from measuring programs.

An overview of the available measured values (operands) and measuring programs that provide these operands is shown below:

- **Points:**
 - Maximum Point
 - Minimum Point
 - First Point
 - Last Point
 - Absolute Angle/Offset (if using algorithm "Center of gravity")
 - Intersection Point
 - Single Offset (if using algorithm "Center of gravity")
 - Double Offset (if using algorithm "Center of gravity")
 - Edge Left
 - Edge Right
 - Surface Maximum
 - Surface Minimum
 - Seam Start/End
 - Seam Maximum
 - Groove Start/End
 - Groove Minimum
 - Gap Start/End
 - Gap Center Point

- Circle Center Point
- Circle Vertex
- Circle Seam Start/End
- Circle Seam Maximum
- Circle Groove Start/End
- Circle Groove Minimum
- **Distances:**
 - Absolute Angle/Offset
 - Single Offset
 - Double Offset
 - Step Height
 - Surface Maximum
 - Surface Minimum
 - Seam Width/Height
 - Groove Width/Height
 - Gap Distance X/Z
 - Circle Radius
 - Circle Seam Width/Height
 - Circle Groove Width/Height
- **Angles:**
 - Absolute Angle
 - Absolute Angle/Offset
 - Double Angle
 - Difference Angle
 - Intersection Point
- **Lines:**
 - Absolute Angle
 - Absolute Angle/Offset
 - Double Angle
 - Difference Angle
 - Intersection Point
 - Single Offset
 - Double Offset
 - Step Height

5.2 Defining Operands and Constants for a Combined Signal

Use the "Combined signal x" input field (see Fig. 5.2 and Fig. 5.3) to select the measured values (operands) for the calculation. In addition, you can also define a constant to be added to the result of the calculation. You may determine the absolute value and negate the result.

Combined signal 1

Signal name:

1st operand:

2nd operand:

+ Constant X: Z:

Absolute value X Absolute value Z


Negate X Negate Z

Program 1: Start point X[mm]/Z[mm]:	-0.419 / 72.464
Program 2: Line Angle[°]/Offset[mm]:	28.010 / 60.230
Perpendicular point X[mm]/Z[mm]:	4.746 / 62.754

Fig. 5.3: "Combined signal x" input field

Make the following settings:

- **Signal name:** Enter a name for the combined signal.
- **1st Operand:** Select the first operand for the calculation.
- **2nd Operand:** Select the second operand for the calculation.

- **+ Constant:** Define a constant to be added to the result of the calculation. Press the  button to automatically adjust the constant so that the measured value equals zero.
- **Absolute value:** Activate this parameter in order to determine the absolute value.
- **Negate:** Negate the result.

The currently valid values for the operands and the result of the calculation (including the constant) are shown in the lower part of the input field.

5.3 Defining a new Signal for Calculation

The following example explains how to define a new signal for calculation:

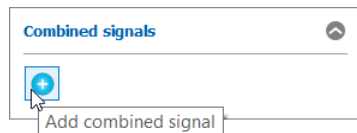


Fig. 5.4: Defining a new signal for calculation - step 1

➡ Press the "Add combined signal" button to add a new signal for calculation (see Fig. 5.4).

The "Algorithm" input field (see Fig. 5.5) will be displayed:

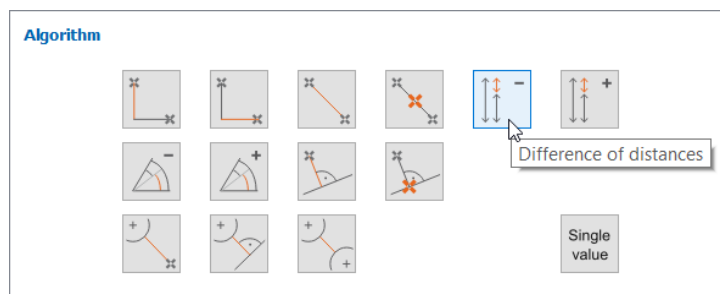
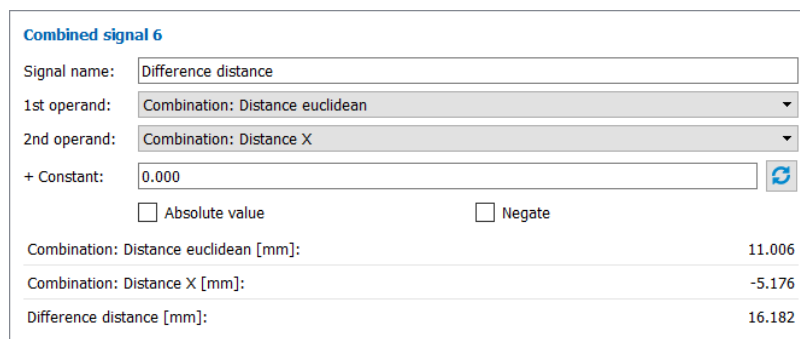


Fig. 5.5: Defining a new signal for calculation - step 2

➡ Select the desired algorithm for the calculation in the "Algorithm" input field (see Chapter 5.1 and Fig. 5.5).

The "Combined signal x" input field is displayed (see Fig. 5.6):



The image shows a configuration form for 'Combined signal 6'. It includes fields for signal name, 1st operand, 2nd operand, and a constant value. There are also checkboxes for 'Absolute value' and 'Negate'. Below the form, a table shows the calculated values for the operands and the resulting signal.

Signal name:	Difference distance
1st operand:	Combination: Distance euclidean
2nd operand:	Combination: Distance X
+ Constant:	0.000
<input type="checkbox"/> Absolute value <input type="checkbox"/> Negate	
Combination: Distance euclidean [mm]:	11.006
Combination: Distance X [mm]:	-5.176
Difference distance [mm]:	16.182

Fig. 5.6: Defining a new signal for calculation - step 3

➡ Use the "Combined signal x" input field (x = 1...8) to define the signal name and to select the operand for the calculation (see Chapter 5.2 and Fig. 5.6). If necessary, define a constant to be added to the result of the calculation. You may determine the absolute value and negate the result.

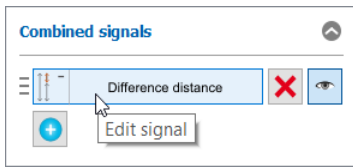


Fig. 5.7: Defining a new signal for calculation - step 4

- Press the button of the active signal (marked in blue, see Fig. 5.7) in the "Combined signals" input field to finish defining the new signal. This takes you back to the overview; all the signals defined for calculation are shown.

6. Filtering and Evaluating Measured Values and Configuring Outputs

Use the "Outputs and Results" view in order to configure the measured values output ports of the scanCONTROL smart product series. Additionally you may choose to filter measured values, to save the configurations of the active measuring programs and of the output ports permanently on scanCONTROL (see Chapter 3.14.4) and to activate the logging of measured values (see Chapter 6.9).

Use the "Outputs and Results" button in the main view (see Chapter 3.2) or the navigation menu (see Chapter 3.19) in order to access the "Outputs and Results" view.

The screenshot displays the 'Outputs and Results' view of the scanCONTROL Configuration Tools. The interface is divided into several sections:

- A: General toolbar** (top left): Contains icons for file operations (save, load, reset) and a 'Filter...' button.
- B: Sensor settings** (middle left): A panel with input fields for 'Exposure time [ms]: 1.00' and 'No. of profiles [1/s]: 25', along with a 'Filter...' button and an 'Advanced...' link.
- Sensor status** (below B): A table showing real-time data: Exposure time [ms]: 1.00, Saturation [%]: 89.9, No. of profiles [1/s]: 24.3, Profile number: 967845, Lost profiles: 19, Encoder value: 0, SN: 213110027, IP address: 169.254.77.106.
- Protocol status** (1): Shows 'Protocol: inactive'.
- Active programs** (2): A table with columns for 'Gap Start / End' and 'Absolute Angle'.
- 2D-display** (C): A plot of Z [mm] vs X [mm] showing a green profile and an orange measurement path.
- Display toolbar** (D): A toolbar with icons for zooming and other display functions.
- Signal status table** (3): A table showing the status of eight signals.
- Status line** (F): A line at the bottom displaying 'Active: scanCONTROL 2610-25 v46B11 18060411AC' and a '<F1> Help' button.

Fig. 6.1: "Outputs and Results" view

Display elements and parameters in the "Outputs and Results" view:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), activate and deactivate the logging of measured values (see Chapter 6.9), save parameters to a file and load parameters from a file (see Chapter 3.14), store parameters permanently on scanCONTROL and load parameters from scanCONTROL (see Chapter 3.14) and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C 2D-display:** This display shows the last measured profile and measurement results.
- D "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Chapter 3.17).
- E Navigation menu:** Click on this button in order to show the navigation menu (see Chapter 3.19).
- F Status line:** Status and error messages are displayed on the status line (see Chapter 9.1). If errors occur in several active measuring programs, the first error found is displayed in the order of the measuring programs.

- 1 Protocol status:** Indicates whether logging is active.
- 2 Active programs:** Displays all active measuring programs. By pressing the corresponding button the "Outputs and Results" view is closed and you enter the selected measuring program. You also may choose to show or hide the measurement results of the individual measuring programs in the 2D-display using the "symbolic eye" buttons.
- 3 Filter/Output:** Using these tabs you can make settings to filter measured values and select the measured values to be output at the available output ports of scanCONTROL (only available for scanCONTROL Smart, see Fig. 1.1, Chapter [6.1](#), [6.2](#), [6.3](#), [6.4](#), [6.5](#), [6.6](#) and [6.7](#)).
- 4 Display of the measurement results:** In the 2D-display, the measurement results determined by the active measuring programs are shown.

6.1 Configuration of the Filters for Measured Values

Configuration Tools provides the possibility to filter measured values chronologically. It is possible to filter up to eight measured values. To do so, select the "Filter" tab. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature and already filtered values are available.

Note: The filtering of already filtered values is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 50).

Filter	OK/nOK	UDP out			
Filter 1	Program 1: Start X [mm] (med_3)	-0.419	Filter 5	None	0.000
Filter 2	Program 1: End X [mm] (med_3)	-0.440	Filter 6	None	0.000
Filter 3	Combination: Distance euclidean [mm] (avg_15)	11.000	Filter 7	None	0.000
Filter 4	None	0.000	Filter 8	None	0.000

Fig. 6.2: "Filter" tab

The current filtered values are listed in the "Filter" tab (see Fig. 6.2). Press the "Filter x" button to configure the respective filter. The following dialog box will be displayed:

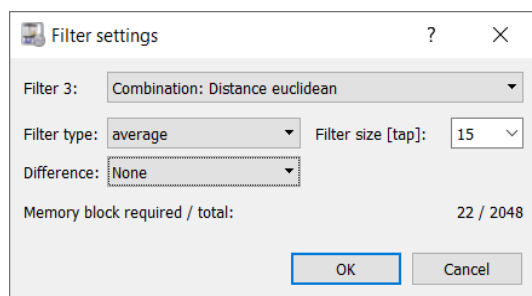


Fig. 6.3: "Filter settings" dialog box

Make the following settings:

- **Filter x:** Select the measured value to be filtered.
- **Filter type:**
 - **average:** Activate an average filter with this parameter.
 - **delay:** This parameter activates the delayed output of a measured value. It is possible to delay the output of a measured value by up to 1023 measurement operations.
 - **median:** Activate a median filter with this parameter.
 - **minumum:** Activate a minimum filter with this parameter.
 - **maximum:** Activate a maximum filter with this parameter.
- **Filter size [tap]:** Enter the filter size.
- **Difference:** Select whether a difference between the filtered and the original value should be calculated.
 - **None:** No difference should be calculated.
 - **Signal - filtered signal:** The filtered measured value is subtracted from the original value.
 - **Filtered signal - Signal:** The original measured value is subtracted from the filtered value.
- **Memory block required / total:** The allocation of the filter memory block is displayed in this information field. The filter memory space of the scanCONTROL measurement system depends on the sensor type and firmware version and is limited.

Confirm your settings with the "OK" button.

The filtered measurement values are labeled as follows: The filter type (avg, del, med, min or max) and filter size are added to the name of the filtered measurement in curved brackets. If a difference is calculated, the original value is indicated by X. For example, (X - med_3) stands for a difference between original measured value and filtered value width median filter of size 3.

Note: The filter memory space of the scanCONTROL measurement system depends on the sensor type and firmware version: scanCONTROL 25X0/26X0/27X0/29X0/30XX (firmware version < 50): 64; scanCONTROL 30XX (firmware version ≥ 50): 2048.

6.2 Evaluation of Measured Values / Configuration of the Digital Outputs

Configuration Tools provides the possibility to generate up to 8 logical signals for the evaluation of measured values (OK/nOK). Depending on the type of sensor and configuration, scanCONTROL Smart has up to 8 digital outputs at which the evaluated measured values can be output. In order to activate the digital outputs, select the "output unit + serial", "output unit + UDP" or "output unit + UDP profiles" option of the "Interface/Protocol" parameter and the "Active" option of the "Mode Output Unit" parameter (see Chapter 3.9, "Interfaces" tab, Section 1). Even with deactivated digital outputs, the evaluated measured values (OK/nOK) can be output (see Chapters 6.4, 6.5, 6.6 and 6.7). In the "Digital out" or "OK/nOK" tab, select the signals to be issued at the digital outputs. The measured values and status signals of all active measuring programs, a status signal for the complete measurement, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode, the filtered measured (see Chapter 6.1) values and already configured digital outputs are available.

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

Filter	OK/nOK	UDP out	
Signal 1	Program 1: Start X [mm]	-0.419	Signal 5 None 0.000
Signal 2	Program 1: End X [mm]	-0.440	Signal 6 None 0.000
Signal 3	Combination: Distance euclidean [mm]	11.001	Signal 7 None 0.000
Signal 4	None	0.000	Signal 8 None 0.000

Fig. 6.4: "Digital out" tab

The "Digital out" tab (see Fig. 6.4) shows the actual values for the digital outputs of scanCONTROL. Use the "Port x" buttons in order to configure the according output ports. The "Digital port settings" dialog is displayed.

Fig. 6.5: "Digital port settings x" dialog

The following settings are available:

- **Signal name:** Enter a name for the evaluated signal.
- **Value x:** Select the measured value to be evaluated.
 - **Min:** The lower limit of the range for the evaluation of the selected measured value.
 - **Max:** The upper limit of the range for the evaluation of the selected measured value.

Note: The accuracy of scanCONTROL is limited. The entered limits are automatically corrected for the accuracy of the connected scanCONTROL measurement system.

- **Invert:** Dependent on the setting of this parameter the selected digital out port behaves as follows:
 - **Inactive:** If the signal is within the specified range a logical 1 (OK) will be issued at the digital output, otherwise a logical 0 (nOK) will be issued. If the measurement value is equal to the range limits a logical 1 (OK) will be issued. In the case of output of a status signal, a logical 1 (OK) will be issued at the digital output if no error has occurred during the measurement. If an error occurs during the measurement, a logical 0 (nOK) will be issued.
 - **Active:** If the signal is within the specified range a logical 0 (nOK) will be issued at the digital output, otherwise a logical 1 (OK) will be issued. If the measurement value is equal to the range limits a logical 0 (nOK) will be issued. In the case of output of a status signal, a logical 0 (nOK) will be issued at the digital output if no error has occurred during the measurement. If an error occurs during the measurement, a logical 1 (OK) will be issued.
- **Logical link:** Specify whether the current result of the evaluation has to be logical linked with another signal. You may link up to eight signals. The following algorithms are available for linking measured values:
 - **AND:** Logical AND link.
 - **OR:** Logical OR link.
 - **XOR:** Logical XOR link.

In addition to the evaluation, you can specify whether the signal must meet an adjusted condition over several measurements before it will be issued at the digital output (evaluation of a measurement series). This is, for example, for the elimination of individual measurements, which are irrelevant for the evaluation of the measurement series.

➡ To do so, press the "Counter settings..." button (see Fig. 6.5) in order to show the "Digital port counter settings" dialog box (see Fig. 6.6).

If the evaluation of a measurement series is active for the current port, the font of the "Counter settings..." button appears red or green.

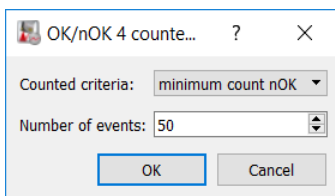


Fig. 6.6: "Digital port counter settings" dialog

Make the following settings:

- **Counted criteria:** Define the condition for the evaluation of the measurement series:
 - **minimum count OK:** The Measurement series is OK if at least N consecutive measurements have been evaluated as OK.
 - **minimum count nOK:** The Measurement series is nOK if at least N consecutive measurements have been evaluated as nOK.
 - **hold OK:** When a measurement is evaluated as OK, the N-1 subsequent measurements will also automatically be evaluated as OK.
 - **hold nOK:** When a measurement is evaluated as nOK, the N-1 subsequent measurements will also automatically be evaluated as nOK.
- **Number of events:** Enter the number N of measurements for the evaluation of the measurement series.
 - ➡ Confirm your settings with the "OK" button.

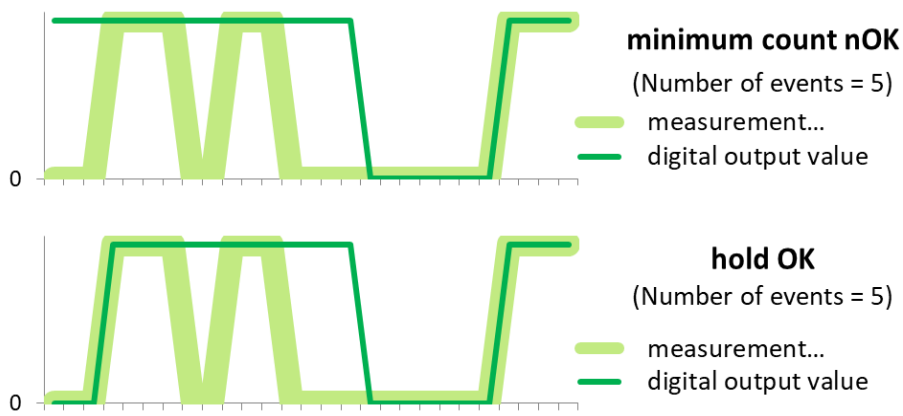


Fig. 6.7: "Digital port counter" example

➤ Confirm your settings with the "OK" button.

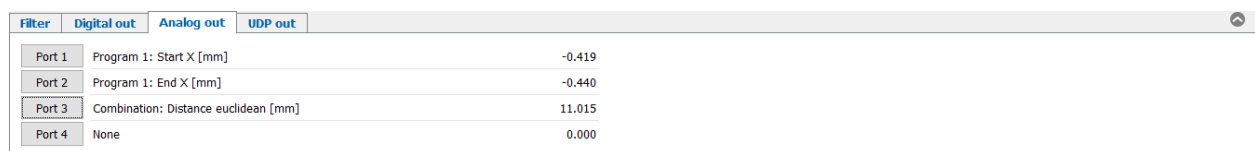
Note: By default, the logical value corresponds to the electrical level (OK = high level, nOK = low level). In case of activating the "Invert level" parameter (see Chapter 3.9), the electrical signal, output at the digital outputs, is inverted (OK = low level, nOK = high level).

6.3 Configuration of the Analog Outputs

Depending on the type of sensor and configuration, scanCONTROL Smart has up to four analog outputs. In order to activate the analog outputs, select the "output unit + serial", "output unit + UDP" or "output unit + UDP profiles" option of the "Interface/Protocol" parameter and the "Active" option of the "Mode Output Unit" parameter (see Chapter 3.9, "Interfaces" tab, Section 1). In the "Analog out" tab, select the signals to be issued at the analog outputs. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured (see Chapter 6.1) values are available.

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).



Port	Signal	Value
Port 1	Program 1: Start X [mm]	-0.419
Port 2	Program 1: End X [mm]	-0.440
Port 3	Combination: Distance euclidean [mm]	11.015
Port 4	None	0.000

Fig. 6.8: "Analog out" tab

Note: The "Analog out" tab is only available if the analog outputs are active (see Chapter 3.9, "Interfaces" tab, Section 1).

The "Analog out" tab (see Fig. 6.8) shows the actual values for the analog outputs of scanCONTROL. Use the "Port x" buttons in order to configure the according output ports. The "Analog port settings" dialog is displayed.

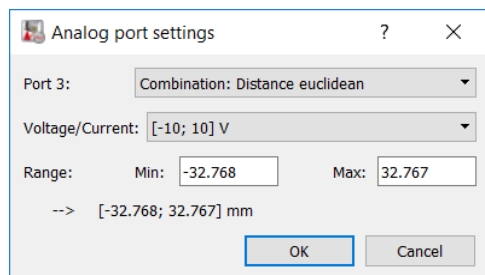


Fig. 6.9: "Analog port settings" dialog

The following settings are available:

- **Port x:** Select the measurement result which should be issued at the respective port x ($x = 1 \dots 4$).
- **Voltage:**
 - Specify the analog output clamp of the 2D/3D Output Unit you are using. The specified range of measured values ("Range min" and "Range max") is mapped to the voltage or current range of the output clamp:
 - [-10; 10] V
 - [0; 10] V
 - [0; 20] mA
 - [4; 20] mA
- **Range:** Input the possible range of the measured value. The output signal will be scaled so that the range of the measured value is mapped to the voltage range.
 - **Min:** The lower limit of the measured value range.
 - **Max:** The upper limit of the measured value range.

Note: The scaling resolution of scanCONTROL is limited. Configuration Tools calculates the range next in size from the settings in the "Range" input field for the respective signal. The range actually used is shown in the display "--> [min; max]".

Confirm your settings with the "OK" button.

6.4 Configuration of the RS422 Port

scanCONTROL Smart has a RS422 port (scanCONTROL 25X0/26X0/29X0: half-duplex; scanCONTROL 27X0: full-duplex) to output measured values. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured values (see Chapter 6.1) are available. Also the error codes (see Chapter 9.1) of all active measuring programs, the number of the current profile, the states of the digital outputs and the current encoder value or state of the digital inputs are available. The measured values can be transmitted as ASCII string or in binary format (see Chapter 8.2.4).

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

Filter	Digital out	Analog out	Serial out
Signals	Number of active signals:	3	Signal 1: Program 1: Start X -7.479
	Baudrate:	115200	Signal 2: Program 1: Start Z 88.082
	Min. signal size:	0	Signal 3: Combination: Distance euclidean 12.886
	Separator values/measurements:	tabulator/	

Fig. 6.10: "Serial out" tab

Note: The "Serial out" tab is only available if the "Interface/protocol" parameter in the "Advanced scanner settings" dialog box is set to "output unit + serial" (see Chapter 3.9, "Interface" tab, section 1).

Note: If you want to output the current encoder value, make sure the encoder input of scanCONTROL is enabled (see Chapter 3.9, "Interface" tab, parameters "Digital input mode" and "Encoder active"). If you want to output the state of the digital inputs, make sure that it is included in the timestamp of the profiles (see Chapter 3.9, "Interface" tab, parameter "Digital input mode").

The number of output measured values, the configuration of the RS422 interface and the selected measured values are displayed in the "Serial out" tab (see Fig. 6.10). Use the "Signals" button in order to configure the RS422 port. The "Serial out settings" dialog is displayed.

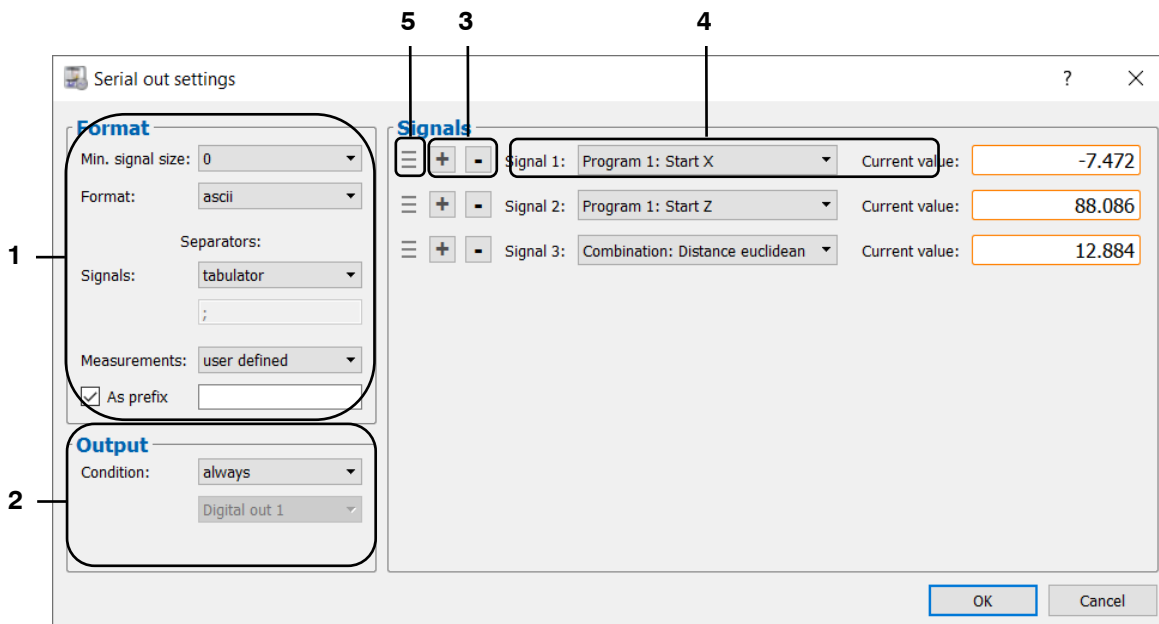




Fig. 6.11: "Serial out settings" dialog

The following settings are available:

- 1 - **Min. signal size:** The minimum number of characters which will be transferred per measured value. If the number of characters which are needed for the transmission of a measured value is smaller than the specified parameter, leading spaces will be inserted for the measured value. If the length of the measured value is greater than the specified parameter, the measured value is transferred unchanged.
 - **Format:** Specify whether the measured values will be transmitted as ASCII string or in binary format.
 - **Separator for measured values:**
 - **Signals:** Define a separator which will be inserted after each measured value:
 - **tabulator:** A tabulator will be inserted as separator.
 - **line feed:** A line feed character will be inserted as separator.
 - **user defined:** Define up to 4 characters which will be inserted after each measured value.
 - **Separator for measurements:**
 - **Measurements:** Define a separator which will be inserted before or after each measurement:
 - **tabulator:** A tabulator will be inserted as separator.
 - **line feed:** A line feed character will be inserted as separator.
 - **user defined:** Define up to 4 characters which will be inserted before or after each measurement.
 - **As prefix:** On activating this parameter the separator will be inserted before each measurement. When deactivating this parameter the separator will be inserted after each measurement.
- 2 - **Condition:** Define the output condition of measured values:
 - **always:** The measured values are output for each measurement operations.
 - **nOK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as nOK.
 - **OK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as OK.

If an output condition is activated, the "Serial out" tab (see Fig. 6.10) shows the output criterion, its state and the measured values as well as the outputted measured values.
- 3 - Add/Remove signals:
 -  Press this button, in order to add a measured value for output using the RS422 interface.
 -  Press this button, in order to remove the selected measured value.
- 4 - Select the measured value to be output using the RS422 interface.
- 5 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

Note: Use the "Interface" tab sheet in the "Advanced scanner settings" dialog (see Chapter 3.9) in order to set the baudrate for the RS422 interface.

The following port parameters are preset in scanCONTROL and cannot be changed:

- **Data bits:** 8
- **Parity:** none
- **Stop bits:** 2
- **Flow control:** none

 Confirm your settings with the "OK" button.

Note: A maximum of 160 characters per measurement can be transmitted via the RS422 port. If more characters are transmitted, the residual characters are discarded.

Note: The measured values are transmitted to the RS422 interface using sensor coordinates. Please refer to the table in Chapter [8.2.4](#) for the conversion of the measured values to real coordinates.

Note: The separator for measured values and the "Min. signal size" parameter are only available when using the ASCII format.

Note: In case of binary output of measured values, data is transferred in big-endian format.

6.5 Configuration of the Outputs using UDP

scanCONTROL Smart provides the possibility to output the results via Ethernet using UDP. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured values (see Chapter 6.1) are available. Also the error codes (see Chapter 9.1) of all active measuring programs, the number of the current profile, the states of the digital outputs and the current encoder value or state of the digital inputs are available. The measured values can be transmitted as ASCII string or in binary format (see Chapter 8.2.4).

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

Filter	Digital out	Analog out	UDP out
Number of active signals:		3	Signal 1: Program 1: Start X Signal 2: Program 1: Start Z Signal 3: Combination: Distance euclidean
IP address/Port:	169.254.3.1/61000		
Min. signal size:		0	
Separator values/measurements:		tabulator/	
			-8.986 87.534 11.843

Fig. 6.12: "UDP out" tab

Note: The "UDP out" tab is only available if the "Interface/protocol" parameter in the "Advanced scanner settings" dialog box is set to "output unit + UDP" (see Chapter 3.9).

Note: If you want to output the current encoder value, make sure the encoder input of scanCONTROL is enabled (see Chapter 3.9, "Interface" tab, parameters "Digital input mode" and "Encoder active"). If you want to output the state of the digital inputs, make sure that it is included in the timestamp of the profiles (see Chapter 3.9, "Interface" tab, parameter "Digital input mode").

The number of output measured values, the configuration for the output using UDP and the selected measured values are displayed in the "UDP out" tab (see Fig. 6.12). Use the "Signals" button in order to configure the output of the measured values using UDP. The "UDP settings" dialog is displayed.

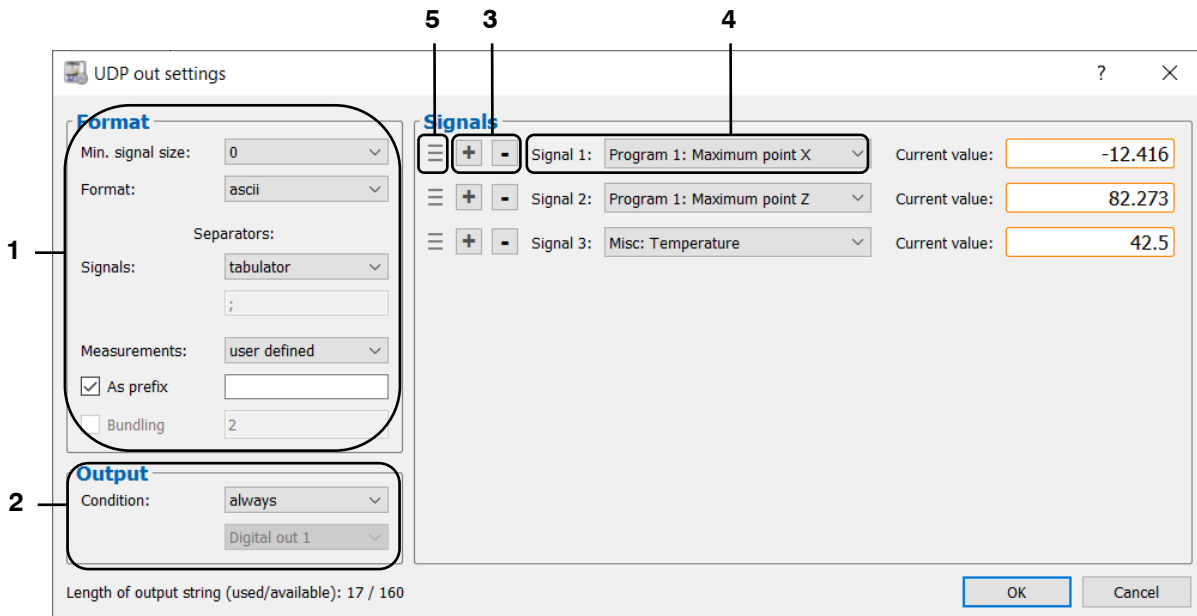


Fig. 6.13: "UDP out settings" dialog



The following settings are available:

- 1 - **Min. signal size:** The minimum number of characters which will be transferred per measured value. If the number of characters which are needed for the transmission of a measured value is smaller than the specified parameter, leading spaces will be inserted for the measured value. If the length of the measured value is greater than the specified parameter, the measured value is transferred unchanged.
- **Format:** Specify whether the measured values will be transmitted as ASCII string or in binary format.
- **Separator for measured values:**
 - **Signals:** Define a separator which will be inserted after each measured value:
 - **tabulator:** A tabulator will be inserted as separator.
 - **line feed:** A line feed character will be inserted as separator.
 - **user defined:** Define up to 4 characters which will be inserted after each measured value.
- **Separator for measurements:**
 - **Measurements:** Define a separator which will be inserted before or after each measurement:
 - **tabulator:** A tabulator will be inserted as separator.
 - **line feed:** A line feed character will be inserted as separator.
 - **user defined:** Define up to 4 characters which will be inserted before or after each measurement.
- **As prefix:** On activating this parameter the separator will be inserted before each measurement. When deactivating this parameter the separator will be inserted after each measurement.
- **Bundling:** Define whether the measured values selected for binary output are to be collected over several measurements (2-255) and output as a package.
 - **Bundle size (2-255):** Number of measurements for bundling the measured values.

Note: In order to be able to assign the output measured values to the individual measurements, it is recommended to output the profile number in addition to the measured values.

- 2 - **Condition:** Define the output condition of measured values:
 - **always:** The measured values are output for each measurement operations.
 - **nOK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as nOK.
 - **OK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as OK.

If an output condition is activated, the "UDP out" tab (see Fig. 6.12) shows the output criterion, its state and the measured values as well as the outputted measured values.

- 3 - Add/Remove signals:
 -  Press this button, in order to add a measured value for output using the UDP interface.
 -  Press this button, in order to remove the selected measured value.

- 4 - Select the measured value to be output using the UDP interface.
- 5 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

 Confirm your settings with the "OK" button.

Note: Use the "Interface" tab sheet in the "Advanced scanner settings" dialog (see Chapter 3.9) in order to set the IP address and the UDP port of the receiver (client) of the measured values.

Note: scanCONTROL uses source port 8000 for the UDP connection.

Note: A maximum of 160 characters per measurement can be transmitted. If more characters are transmitted, the residual characters are discarded.

Note: The transmission of the measured values in the packet is limited to 1440 characters. If more characters are transmitted, the residual characters are discarded.

Note: The measured values are transmitted via Ethernet using sensor coordinates. Please refer to the table in Chapter [8.2.4](#) for the conversion of the measured values to real coordinates.

Note: The separator for measured values and the "Min. signal size" parameter are only available when using the ASCII format.

Note: The transmission of the bundled measured values is only available when using a scanCONTROL 30XX measurement system in binary format.

Note: In case of binary output of measured values, data is transferred in big-endian format.

6.6 Configuration of the Outputs using Modbus

Configuration Tools provides the possibility to output the results using Modbus. The results are output to the RS422 port and via Ethernet. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured values (see Chapter 6.1) are available. Also the error codes (see Chapter 9.1) of all active measuring programs, the number of the current profile, the states of the digital outputs and the current encoder value or state of the digital inputs are available. The states of the digital outputs are transmitted in binary format (see Chapter 8.2.4).

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

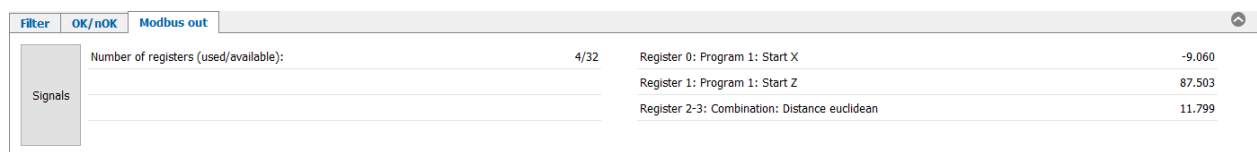


Fig. 6.14: "Modbus out" tab

Note: The "Modbus out" tab is only available if the "Interface/protocol" parameter in the "Advanced settings" dialog box is set to "modbus" or "modbus + UDP profiles" (see Chapter 3.9).

Note: If you want to output the current encoder value, make sure the encoder input of scanCONTROL is enabled (see Chapter 3.9, "Interface" tab, parameters "Digital input mode" and "Encoder active"). If you want to output the state of the digital inputs, make sure that it is included in the timestamp of the profiles (see Chapter 3.9, "Interface" tab, parameter "Digital input mode").

The number of used Modbus registers and the selected measured values are displayed in the "Modbus out" tab (see Fig. 6.14). Use the "Signals" button to configure the Modbus interface. The following dialog is displayed:

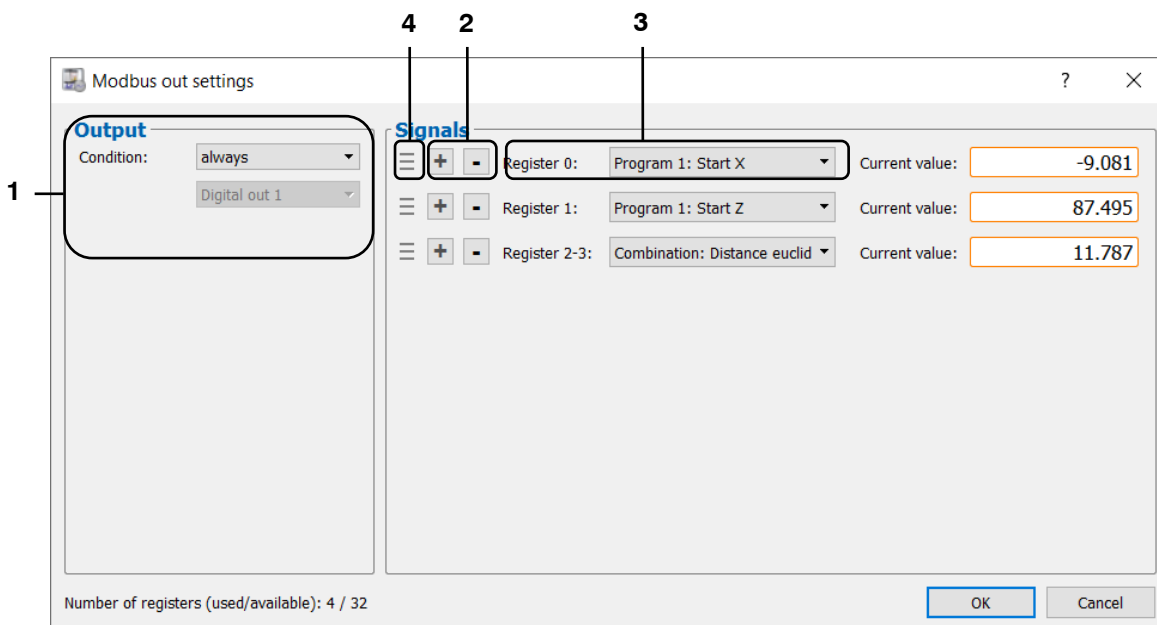




Fig. 6.15: "Modbus out settings" dialog

The following settings are available:

- 1 - **Condition:** Define the output condition of measured values:
 - **always:** The measured values are output for each measurement operations.
 - **nOK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as nOK.
 - **OK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as OK.

If an output condition is activated, the "Modbus out" tab (see Fig. 6.14) shows the output criterion, its state and the measured values as well as the outputted measured values.

- 2 - Add/Remove signals:
 -  Press this button, in order to add a measured value for output using the modbus protocol.
 -  Press this button, in order to remove the selected measured value.
- 3 - Select the measured value to be output using the modbus protocol.
- 4 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

 Confirm your settings with the "OK" button.

Note: Up to 32 Modbus registers (16 bits each) can be used. Depending on the type a measured value requires 16 or 32 bits, i.e. one or two registers. When transmitting a 32 bit value the upper 16 bits are stored in the first and the lower 16 bits in the second register.

Note: The measured values are transmitted in sensor coordinates. Please use the table in Chapter [8.2.4](#) to convert the measured values to real coordinates.

Note: Data is transferred in big-endian format.

6.7 Configuration of 2D/3D Gateway

Configuration Tools provides the possibility to output the results via ProfiNET, Ethernet/IP or EtherCAT by using the 2D/3D Gateway. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured values (see Chapter 6.1) are available. Also the error codes (see Chapter 9.1) of all active measuring programs, the number of the current profile, the states of the digital outputs and the current encoder value or state of the digital inputs are available. The states of the digital outputs are transmitted in binary format (see Chapter 8.2.4).

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

Number of registers (used/available):	Register	Current value
4/32	Register 0: Program 1: Start X	-9.219
	Register 1: Program 1: Start Z	87.417
	Register 2-3: Combination: Distance euclidean	11.675

Fig. 6.16: "Gateway out" tab

Note: The "Gateway out" tab is only available if the "Interface/protocol" parameter in the "Advanced settings" dialog box is set to "gateway" or "gateway + UDP profiles" (see Chapter 3.9,).

Note: If you want to output the current encoder value, make sure the encoder input of scanCONTROL is enabled (see Chapter 3.9, "Interface" tab, parameters "Digital input mode" and "Encoder active"). If you want to output the state of the digital inputs, make sure that it is included in the timestamp of the profiles (see Chapter 3.9, "Interface" tab, parameter "Digital input mode").

The number of used Gateway registers and the selected measured values are displayed in the "Gateway out" tab (see Fig. 6.16). Use the "Signals" button to configure the Gateway interface. The following dialog is displayed:

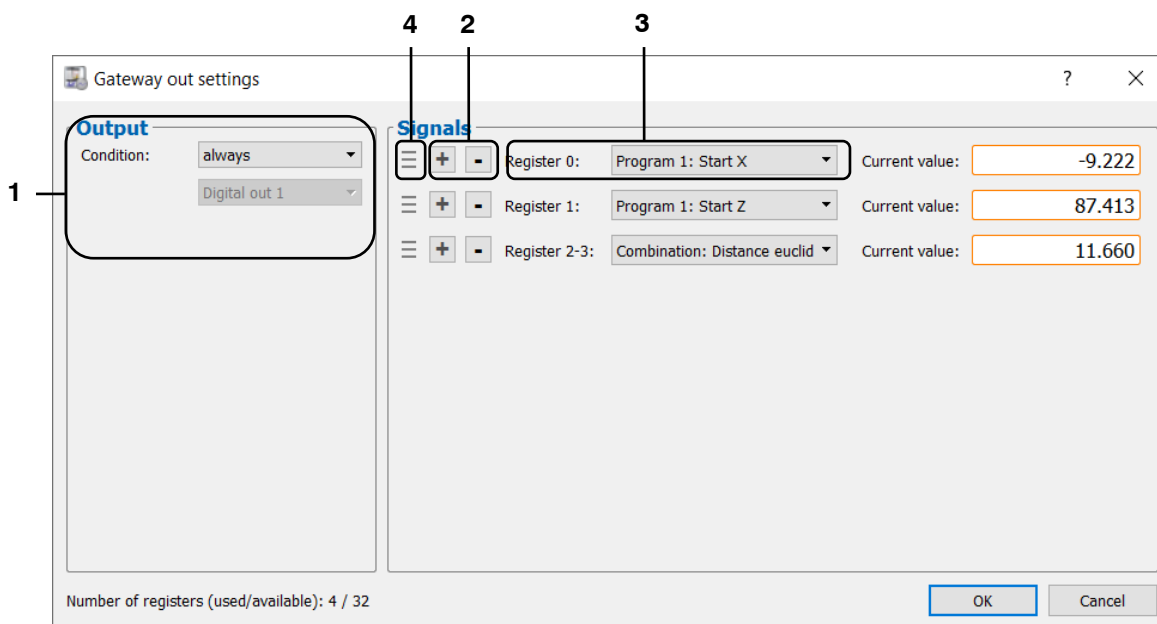




Fig. 6.17: "Gateway out settings" dialog

The following settings are available:

- 1 - **Condition:** Define the output condition of measured values:
 - **always:** The measured values are output for each measurement operations.
 - **nOK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as nOK.
 - **OK:**
 - **Digital out x:** The measured values are outputted if digital output x has been evaluated as OK.

If an output condition is activated, the "Gateway out" tab (see Fig. 6.16) shows the output criterion, its state and the measured values as well as the outputted measured values.

- 2 - Add/Remove signals:
 -  Press this button, in order to add a measured value for output via 2D/3D Gateway.
 -  Press this button, in order to remove the selected measured value.
- 3 - Select the measured value to be output via 2D/3D Gateway.
- 4 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

 Confirm your settings with the "OK" button.

Note: Up to 32 gateway registers (16 bits each) can be used. Depending on the type a measured value requires 16 or 32 bits, i.e. one or two registers. When transmitting a 32 bit value the upper 16 bits are stored in the first and the lower 16 bits in the second register.

Note: The measured values are transmitted in sensor coordinates. Please use the table in Chapter [8.2.4](#) to convert the measured values to real coordinates.

Note: Data is transferred in big-endian format.

6.8 Append the Results to the Profile Data

Configuration Tools provides the possibility to append the results to the profile data. The results can be readout from the profile data using a software library and processed further. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the sensor temperature, the state of laser switch-off, the current user mode and all filtered measured values (see Chapter 6.1) are available. Also the error codes (see Chapter 9.1) of all active measuring programs, the number of the current profile, the states of the digital outputs and the current encoder or state of the digital inputs value are available. The states of the digital outputs are transmitted in binary format (see Chapter 8.2.4).

Note: The measured value "Laser" varies depending on the sensor type and firmware version: scanCONTROL 30XX (firmware version ≥ 52): state of laser (off/on); scanCONTROL 25X0/26X0/29X0/30XX (firmware version < 52): state of external laser switch-off for measurement systems with a safety lock (option "SI").

Note: The measured value "User mode" is only available when using a scanCONTROL 30XX measurement system (firmware version ≥ 52).

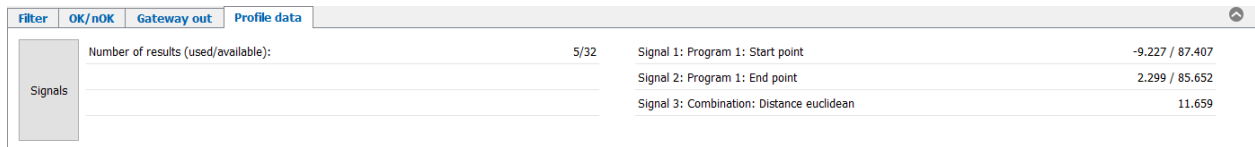


Fig. 6.18: "Profile data" tab

Note: The "Profile data" tab is only available if the "Append to profile data" parameter in the "Advanced scanner settings" box and no profile transfer via Ethernet (UDP) is activated (see Chapter 3.9, "Interface" tab, section 1).

Note: If you want to output the current encoder value, make sure the encoder input of scanCONTROL is enabled (see Chapter 3.9, "Interface" tab, parameters "Digital input mode" and "Encoder active"). If you want to output the state of the digital inputs, make sure that it is included in the timestamp of the profiles (see Chapter 3.9, "Interface" tab, parameter "Digital input mode").

The number of selected results and the selected measured values are displayed in the "Profile data" tab (see Fig. 6.18). Use the "Signals" button to configure the appending of the results to the profile data. The following dialog is displayed:

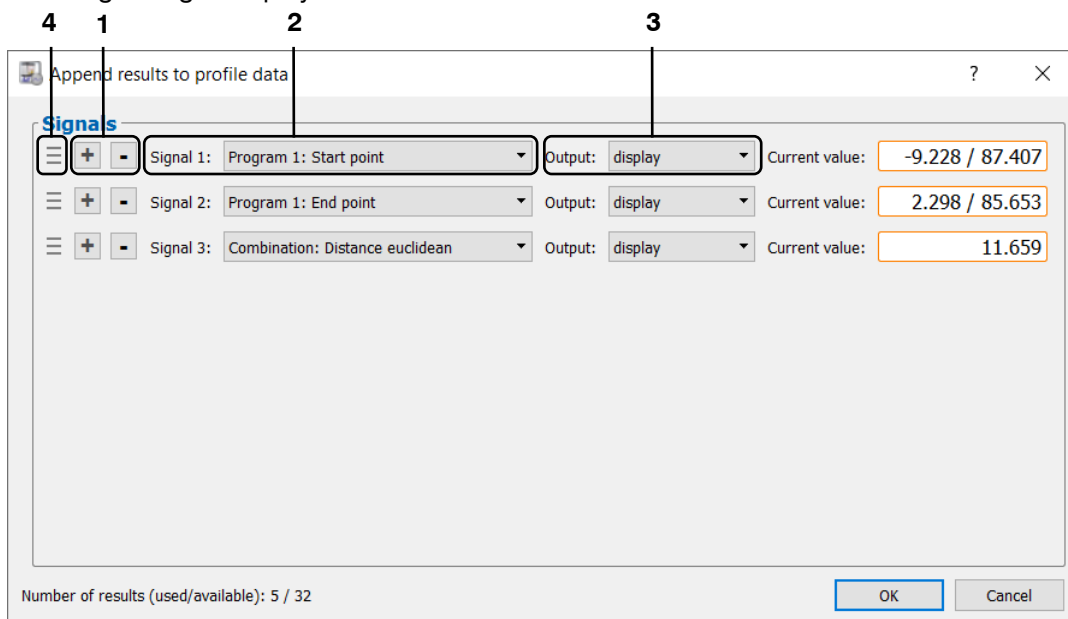




Fig. 6.19: "Append results to profile data" dialog

The following settings are available:

- 1 - Add/Remove signals:
 -  Press this button, in order to append a measured value to the profile data.
 -  Press this button, in order to remove a measured value that was already appended.
- 2 - Select the measured value to be appended to the profile data.
- 3 - Select how the appended measured value is to be treated during readout:
 - **display:** The measured value read out should be displayed on a user interface.
 - **display + output:** The measured value read out should be displayed on a user interface and logged.
- 4 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

 Confirm your settings with the "OK" button.

Note: Up to 32 measured values can be appended to the profile data. When appending a point, two measured values are required.

Note: The measured values are transmitted in sensor coordinates. Please use the table in Chapter [8.2.4](#) to convert the measured values to real coordinates.

6.9 Logging Measured Values

Configuration Tools makes it possible for you to log measured values to an ASCII file. You have the possibility to perform user-defined evaluations with your measurement data.

Note: Logging of measured values is not available in "Display Image Data", "Display Profiles", "Save profiles", "Calibrate position", "Result Monitor" and main view.

Select the "File → Activate protocol results" menu item or press the corresponding button (see Fig. 6.20) in the "General" toolbar.



Fig. 6.20: "Protocol results" button

The "Protocol settings" dialog is displayed (see Fig. 6.21). You may make the settings for logging there.

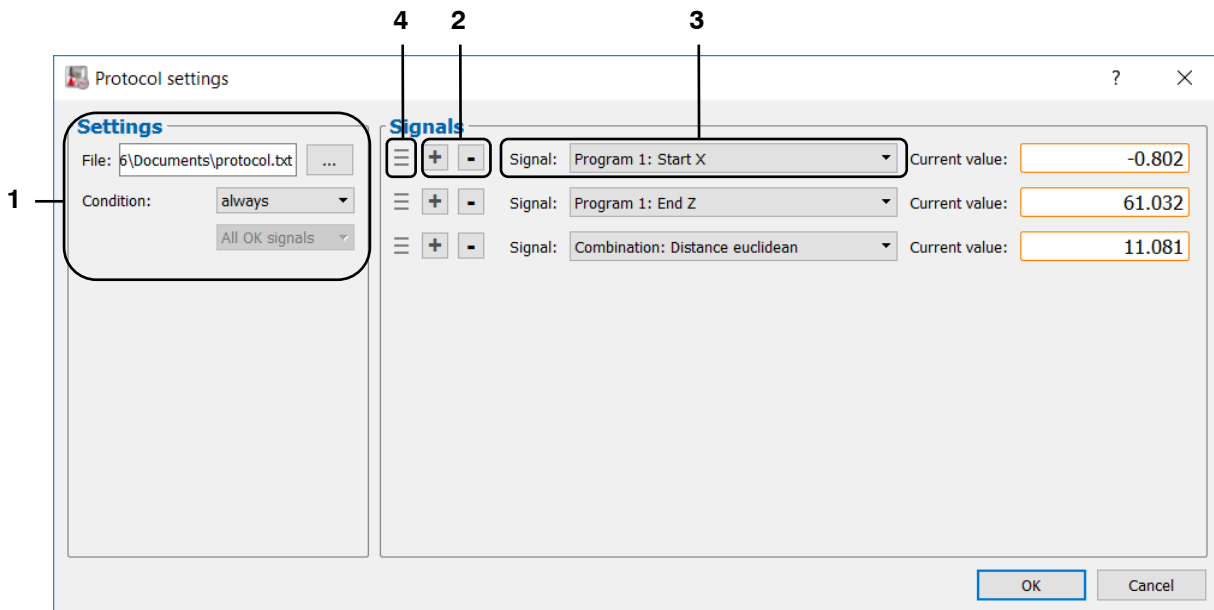


Fig. 6.21: "Protocol settings" dialog

The following settings are available:

- 1 - **Path:** Specify the filename and its complete path where the measured values should be saved. As standard, the file name has the extension ".txt". Use the button "..." in order to select the file using a standard Windows dialog.
- **Condition:** Define the logging condition using this parameter:
 - **always:** All measurement operations are logged.
 - **nOK:**
 - **All digital outs:** Measurement operations where all digital outputs has been evaluated as nOK are logged.
 - **Any digital out:** Measurement operations where at least one digital output has been evaluated as nOK are logged.
 - **Digital out x:** Measurement operations where digital output x has been evaluated as nOK are logged.

- **OK:**
 - **All digital outs:** Measurement operations where all digital outputs has been evaluated as OK are logged.
 - **Any digital out:** Measurement operations where at least one digital output has been evaluated as OK are logged.
 - **Digital out x:** Measurement operations where digital output x has been evaluated as OK are logged.

2 - Add/Remove signals:



Press this button, in order to add a measured value for logging.



Press this button, in order to remove the selected measured value.

3 - Select the measured value for logging.

4 - Change the order of the measured values using "drag & drop". Move the mouse pointer to the dragging area, press the left mouse button and keep it pressed. Now move the mouse pointer to the desired position and release the mouse button. The measured value will be moved to the desired position.

➡ Confirm your settings with the "OK" button in order to start the logging.

Note: You can use the "%" wildcard in the file name. This is then replaced by a counter which is incremented by one for every new start of the logging. In this way you can automatically create a new file for each new log. The counter is reset if you start the "Outputs and Results" view or if you specify a new file name.

In order to stop the logging, use the "File → Deactivate protocol results" menu item or press the corresponding button (see Fig. 6.20) in the "General" toolbar again.

Note: The "Protocol status" area is located on the left side of the "Result Combination", "Outputs and Results" (see Fig. 5.1 and Fig. 6.1) and measuring program views. The current logging status (active/inactive) is displayed in this area.

An example log file can be seen in Fig. 6.22.

	A	B	C	D	E	F	G
1	www.micro-epsilon.com						
2	scanCONTROL Configuration Tools						
3							
4	Active programs:						
5	Program 1: Maximum Point						
6	Program 2: Minimum Point						
7							
8	gapCONTROL 2611-50 v46B11 18060411AC						
9	SN: 213010014						
10	No. of profiles [1/s]: 25						
11	Recently used parameters: UserMode 1						
12							
13	Tolerance for Digital Out (Lower limit/Upper limit)						
14	Port 1: Program 1: Maximum X: 26.000 / 26.500						
15	Port 2: Program 2: Minimum X: 3.000 / 3.500						
16	Port 3: Combination: Distance Z: 10.000 / 10.500						
17	Port 4: None: 0.000 / 0.000						
18	Port 5: None: 0.000 / 0.000						
19	Port 6: None: 0.000 / 0.000						
20	Port 7: None: 0.000 / 0.000						
21	Port 8: None: 0.000 / 0.000						
22							
23	Date	Time	Profile no.	Program 1: Maximum X [mm]	Program 2: Minimum X [mm]	Combination: Distance Z [mm]	
24	09/13/2018	15:58:10:654	213703	26.234	3.212	10.050	
25	09/13/2018	15:58:10:694	213704	26.232	3.212	10.048	
26	09/13/2018	15:58:10:734	213705	26.232	3.212	10.050	
27	09/13/2018	15:58:10:775	213706	26.232	3.214	10.056	
28	09/13/2018	15:58:10:814	213707	26.316	3.212	10.050	
29	09/13/2018	15:58:10:854	213708	26.232	3.212	10.052	
30	09/13/2018	15:58:10:894	213709	26.232	3.212	10.054	
31	09/13/2018	15:58:10:934	213710	26.232	3.212	10.052	

Fig. 6.22: Example log file

7. "Result Monitor" Analysis Program

Use the "Result Monitor" program for statistical analysis of the results of the active measuring program and to save the analysis data in an Excel-compatible format. The analysis data is saved as .csv file. The program includes two 2D-displays showing up to two measured values over time. The measured values of all active measuring programs, the signals defined in the "Result Combination" view (see Chapter 5), the filtered measured values (see Chapter 6.1) and the states of the digital outputs are available for analysis.

Proceed as follows to carry out a statistical evaluation of measured values:

- Use the "Program selector" input field (see Fig. 3.1) in order to select up to 16 measuring programs. The selected programs are shown in the "Active programs" input field.
- Configure the individual measuring programs. To do this, press the according buttons in the "Active programs" input field (see Fig. 3.1) or use the navigation menu (see Chapter 3.19). The view of the selected measuring program will be shown (see Chapter 4).
- Combine measured values, if necessary. You will access the "Result Combination" view (see Chapter 5) by pressing the "Result Combination" button in the "Active programs" input field (see Fig. 3.1) or by using the navigation menu (see Chapter 3.19).
- Configure the filters for measured values and the output ports of scanCONTROL. You will access the "Outputs and Results" view (see Chapter 6) by pressing the "Outputs and Results" button in the "Active programs" input field (see Fig. 3.1) or by using the navigation menu (see Chapter 3.19).
- Start the "Result Monitor" program by pressing the "Result Monitor" button in the "Active programs" input field (see Fig. 3.1) or by using the navigation menu (see Chapter 3.19).

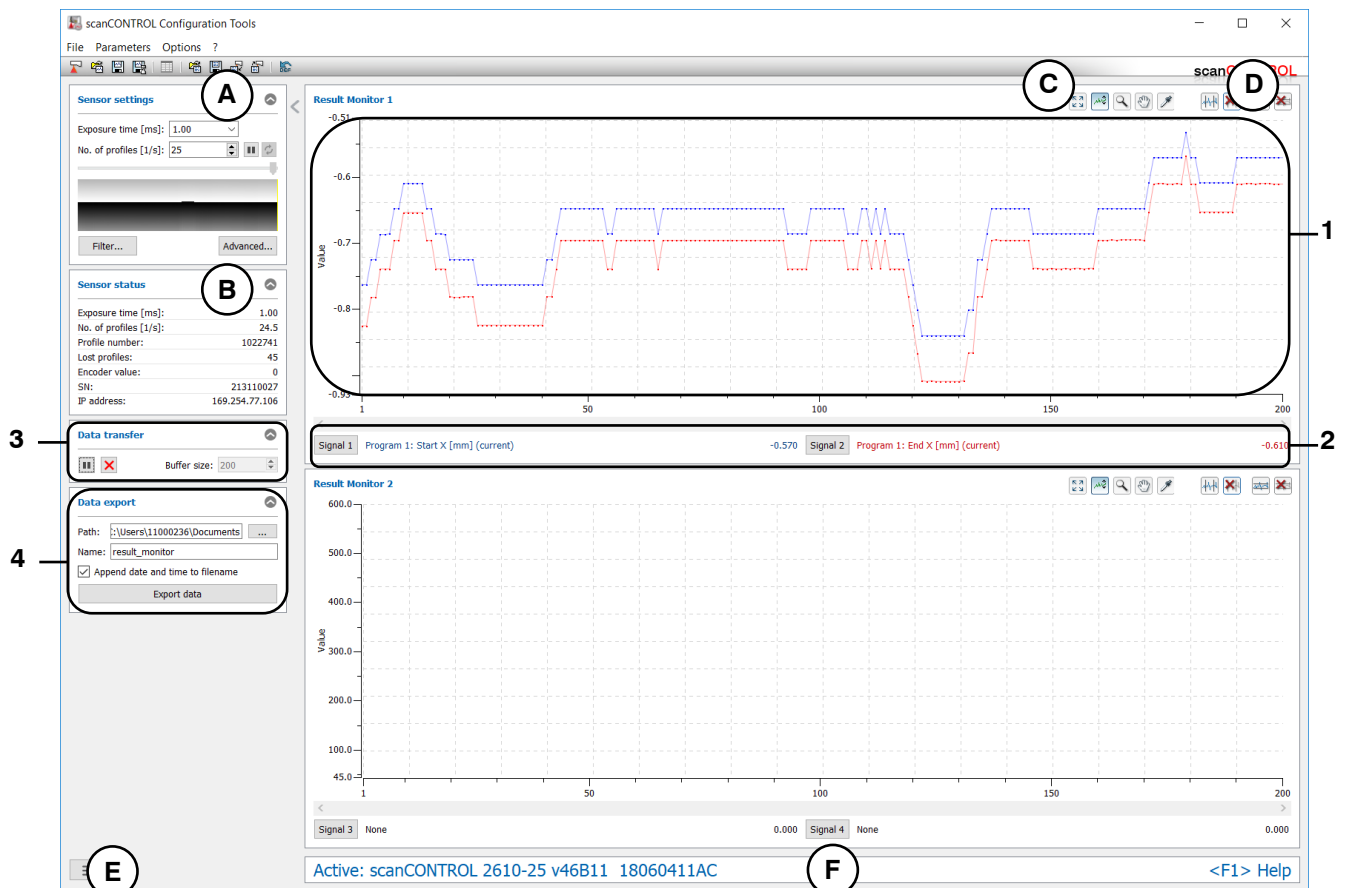







Fig. 7.1: "Result Monitor" analysis program

Display elements and parameters in the "Result Monitor" analysis program:

- A "General" toolbar:** Using this toolbar, you can select the data source (see Chapter 3.5), save profile sequences (see Chapter 3.6), save and load parameters and reset selected parameters to default settings (see Chapter 3.14.3).
- B Scanner settings:** Change the settings of scanCONTROL with these values (see Chapter 3.7). In Offline mode (see Chapter 3.5) this input field will be replaced by the "File settings" input field (see Chapter 3.10) for controlling the playback of a loaded profile sequence.
- C "Display" toolbar:** Using this toolbar, you scale the 2D-display and activate various options for mouse interaction (see Fig. 7.2).



Fig. 7.2: "Display" toolbar in the "Result Monitor" analysis program

-  Resets the 2D-display to the complete value range. This resets the settings of the 2D-display such that the system visualizes the complete analysis over time of the selected measured values.
-  Activates or deactivates automatic scaling of the vertical axis of the 2D-display. If automatic scaling is activated, the vertical axis of the 2D-display automatically adapts to the lowest and highest values of the measured values that you chose for analysis.
-  Activates or deactivates "Zoom" mode. In this mode you can zoom in parts of the 2D-display and so directly set the scaling of the 2D-display with your mouse.
-  Activates or deactivates "Move" mode. In this mode you can move the history of the measured values on the 2D-display.
-  Activates or deactivates "Display extended information of a measuring point" mode.





Note: Use the mouse wheel in order to zoom in and out the 2D-display. You may move to mouse pointer to the time axis and use the mouse wheel in order to scale the time axis of the 2D-display. You may move to mouse pointer to the measurement value axis and use the mouse wheel in order to scale the measurement value axis of the 2D-display.

Note: As well as the mouse interaction, you also have the possibility to manually edit the range to be displayed in the 2D-display. If not already done so, activate the "Zoom" mode and press the right mouse button in the 2D-display. The "Edit zoom range" dialog is then displayed where you can manually edit the values of the range.

- D "Measurement" toolbar:** You can use this toolbar to set the various search areas and limits for measurement (see Fig. 7.3).



Fig. 7.3: "Measurement" toolbar in the "Result Monitor" analysis program

-  Activates or deactivates "Set evaluation lines" mode. Using the evaluation lines, you limit the measured values that are used for statistical evaluation in the 2D-display.
-  Removes the evaluation range. All the recorded values are used for statistical evaluation.
-  Activates or deactivates "Set marker lines" mode. Using this setting, you define two marker lines that are used to acquire undershoots or overshoots (peaks).
-  Removes the marker lines.

E Navigation menu: Click on this button in order to show the navigation menu (see Chapter 3.19).

F Status line: Status and error messages are displayed on the status line (see Chapter 9.1).

1 2D-display: This display visualizes the analysis over time of the selected measured values.

2 Analysis of measured values: In this area, you can choose measured values and the algorithm for the statistical evaluation.

3 Data transfer: Specify the buffer size and control the data transfer.

4 Data export: Export the buffered measured values and the determined statistical characteristics.

Proceed as follows to analyze the developing of a measured value:

➤ Click on the "Signal x" button.

The following dialog is displayed:

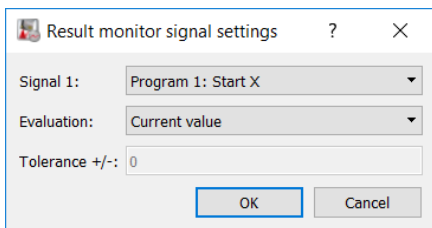


Fig. 7.4: "Result Monitor" dialog box




Make the following settings:

- **Signal x:** Select the measured value to be analyzed.
- **Evaluation:** Select the algorithm for the statistical evaluation:
 - **Current value:** The currently measured value.
 - **Minimum value:** The lowest measured value.
 - **Maximum value:** The highest measured value.
 - **Mean value:** The average value.
 - **No. of min. peaks:** The number of undershoots of the lower marker line.
 - **No. of max. peaks:** The number of overshoots of the upper marker line.
 - **No. of peaks:** Number of undershoots of the lower marker line and of overshoots of the upper one.
 - **Standard deviation:** The standard deviation of the measured values.
 - **Capability gauge measurement (CGM):** The capability index is calculated as follows: $0.2 \cdot \text{abs}(2 \cdot \text{tolerance value}) / (6 \cdot \text{standard deviation})$.

Note: For 50 measured values, the above specifications are sufficient for checking the measurement capability ("Statistical Procedures for Machine and Process Qualification"; 3rd edition; Edgar Dietrich, Alfred Schulze; Carl Hanser Verlag Munich Vienna) if the following condition is fulfilled: $\text{CGM} \geq 1.33$ (method 1).

- **Tolerance +/-:** The tolerance value for calculating the capability index.

To control data transfer, proceed as follows (see Fig. 7.5):

- In the "Buffer size" area, enter the buffer size. The buffer size determines the maximum number of measured values that are used for statistical evaluation. If the maximum number of measured values is reached, the system deletes the oldest values from the buffer and inserts the current ones into it.
- Click on the "Start data transfer"  button to start or resume measured value transfer.
- Click on the "Pause data transfer"  button to stop measured value transfer.
- Click on the "Clear buffer"  button to clear the contents of the buffer.

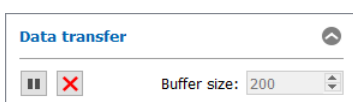


Fig. 7.5: "Data transfer" dialog

Proceed as follows to export the buffered measured values to be monitored and the determined statistical characteristics (see Fig. 7.6):

- In the "Path" field, enter the folder in which you want to save the file.
- In the "Name" field, enter the name of the file to which you want to export the data.
- In the "Append date and time to filename" field, specify whether you want the date and time to be appended to the filename.
- Press the "Export data" button to export the data.

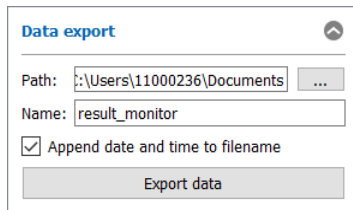


Fig. 7.6: "Data export" dialog

8. Working with the scanCONTROL Smart Measurement System

The scanCONTROL Smart product series measures two-dimensional profile data, evaluates the profile data, determines measured values and evaluates them. The measured values are output at various ports. Configuration Tools is used for parameterization of the measurement system and for the visualization of the measurement results. If the parameterization has been completed, the software can be closed and the measurement system can be disconnected from the PC. The scanCONTROL measurement system then continues to operate as an independent unit and performs the measurements. Handling the measurement system and the interfaces is described in the following.

Note: Exit the software first and **afterwards** disconnect the connection between the measurement system and the PC.

8.1 Operating Modes

In measuring mode there are two different operating modes available which can be configured in Configuration Tools (see Parameter "Trigger mode," Chapter 3.9).

8.1.1 Continuous Measurement

scanCONTROL measures continuously at the specified scan rate.

8.1.2 Triggered Measurement

Depending on the type of sensor, the following interfaces are available for triggering scanCONTROL:

- **scanCONTROL 25X0/26X0/29X0/30XX:** RS422 interface (half-duplex), digital input
- **scanCONTROL 27X0:** RS422 interface (full-duplex)

Every trigger signal triggers a measurement operation. For technical details, please refer to the instruction manual of the measurement system used.

RS422 interface					
scanCONTROL 25X0/26X0/29X0			scanCONTROL 30XX		
Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color	Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color
4	GND-In1	green	10	GND-RS422	violet
11	RS422 -	gray-pink	11	RS422 -	grey-pink
12	RS422 +	red-blue	12	RS422 +	red-blue

Digital input					
scanCONTROL 25X0/26X0/29X0			scanCONTROL 30XX		
Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color	Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color
4	GND-In1	green	7	GND-In	black
6	In1	yellow	4	In1	green

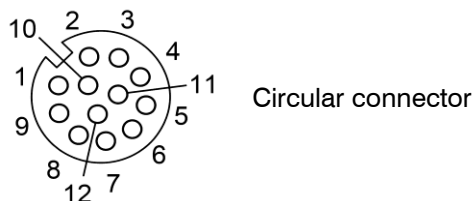


Fig. 8.1: scanCONTROL 25X0/26X0/29X0/30XX trigger input (RS422 interface half-duplex and digital input, view on solder pin side of connector)

scanCONTROL 27X0		
Pin	Assignment	sc2700-x wire color
1	RX +	white
2	RX -	brown
5	GND	gray



Counter-clockwise direction

Fig. 8.2: scanCONTROL 27X0 trigger input ("RS422" jack, view on solder pin side of connector)

8.2 Measurement Value Output

8.2.1 Pin Assignment of the Analog Outputs

For detailed information on the pin assignment and operating mode of the analog outputs please refer to the instruction manual of the measurement system used and to the documentation of the used fieldbus coupler and output clamp.

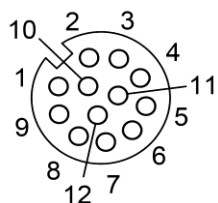
8.2.2 Pin Assignment of the Digital Outputs

For detailed information on the pin assignment and operating mode of the digital outputs please refer to the instruction manual of the measurement system used and to the documentation of the used fieldbus coupler and output clamp.

8.2.3 Pin Assignment of the RS422 Interface

The scanCONTROL Smart measurement system comes with a RS422 output (scanCONTROL 25X0/26X0/29X0/30XX: half-duplex; scanCONTROL 27X0: full-duplex) for supplying selected measurement values (see Chapter 6.4).

scanCONTROL 25X0/26X0/29X0			scanCONTROL 30XX		
Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color	Pin	Assignment	PC2600/PC2900-x/ PCR3000-x wire color
4	GND-In1	green	10	GND-RS422	violet
11	RS422 -	gray-pink	11	RS422 -	grey-pink
12	RS422 +	red-blue	12	RS422 +	red-blue



Circular connector

Fig. 8.3: scanCONTROL 25X0/26X0/29X0/30XX RS422 interface half-duplex (view on solder pin side of connector)

scanCONTROL 27X0		
Pin	Assignment	sc2700-x wire color
1	RX1 +	white
2	RX1 -	brown
3	TX2 +	green
4	TX2 -	yellow
5	GND1	gray
6	GND2	pink



Counter-clockwise direction

Fig. 8.4: scanCONTROL 27X0 RS422 interface full-duplex (view on solder pin side of connector)

8.2.4 Convert the Measured Values to real Coordinates

The measured values are transferred to the RS422 port (ASCII or Modbus, see Chapter 6.4, 6.6), to the Ethernet interface (UDP or Modbus, see Chapter 6.5, 6.6) or via ProfiNET, Ethernet/IP or EtherCAT (only with 2D/3D Gateway, see Chapter 6.7). In doing so, the values are transferred in sensor coordinates. Please use the following table for the conversion of the measured values to real coordinates:

Measured value	Conversion	Format	x Signed
X coordinates [mm]	$y = (x - 32768) * a;$	16 bit	no
X coordinates of circle center point [mm]		32 bit	yes
Z coordinates [mm]		16 bit	no
Z coordinates of circle center point [mm]	$y = (x - 32768) * a + b;$	32 bit	yes
Offset [mm]		32 bit	yes
Angle [°]	$y = 0.01 * x;$	16 bit	yes
Sigma [mm]		16 bit	no
Height [mm]	$y = x * a;$	32 bit	yes
Width [mm]		32 bit	yes
Radius [mm]		32 bit	no
Area [mm ²]	$y = x * a^2;$	32 bit	yes
Temperature [°C]	$y = 0.1 * x - 273.10$	16 bit	no
Number of points		16 bit	no
Profile number	$y = x;$	24 bit	no
Encoder value		16 bit	no

Combined value	Conversion	Format	x Signed
X coordinates [mm]	$y = (x - 32768) * a;$	32 bit	yes
Z coordinates [mm]	$y = (x - 32768) * a + b;$	32 bit	yes
Distance X [mm]		32 bit	yes
Distance Z [mm]		32 bit	yes
Distance euclidean [mm]	$y = x * a;$	32 bit	yes
Difference of distances [mm]		32 bit	yes
Sum of distances [mm]		32 bit	yes
Distance point to line [mm]		32 bit	yes
Difference of angles [°]	$y = 0.01 * x;$	32 bit	yes
Sum of angles [°]		32 bit	yes

The constants a (scaling) and b (offset) for the conversion into millimeters have the following values depending on the type of sensor:

Type of sensor	a	b
scanCONTROL 25X0-25	0.001	65
scanCONTROL 25X0-50	0.002	95
scanCONTROL 25X0-100	0.005	250
scanCONTROL 26X0-25	0.001	65
scanCONTROL 26X0-50	0.002	95
scanCONTROL 26X0-100	0.005	250
scanCONTROL 27X0-25	0.001	100
scanCONTROL 27X0-50	0.002	210
scanCONTROL 27X0-100	0.005	450

Type of sensor	a	b
scanCONTROL 29X0-10	0.0005	55
scanCONTROL 29X0-25	0.001	65
scanCONTROL 29X0-50	0.002	95
scanCONTROL 29X0-100	0.005	250
scanCONTROL 30XX-25	0.001	85
scanCONTROL 30XX-50	0.002	125
scanCONTROL 30XX-100	0.005	270
scanCONTROL 30XX-200	0.007	310
scanCONTROL 30XX-430	0.010	520
scanCONTROL 30XX-600	0.015	800

For inverting the profile points (see Chapter 3.9, "Invert in Z direction" parameter) the following formula is used:

$$z[\text{mm}]_{\text{inverted}} = 2*b - a - z[\text{mm}]$$

When transmitting the states of the digital outputs you may choose to transfer the states as ASCII string or in binary format (see Chapter 6.2). The states of all eight digital outputs are transmitted. Using the ASCII format one character ("0" or "1") is used for each output. Using the binary format one bit is used for each output; in other words, one byte is used to transmit the states of all eight outputs.

Note: In case of converting the measured values into micrometers or inches, you have to consider the following multiplication factors: Micrometers: 1000; Inches: 1/25.4

8.3 Loading of "User Modes"

The scanCONTROL Smart product series is able to save parameter configurations (user modes, see Chapter 3.14.4). The individual configurations can be loaded via different interfaces. For further details, please refer to the instruction manual of the measurement system used.

Available interfaces for loading user modes:

	scanCONTROL 25X0/26X0/29X0/30XX	scanCONTROL 27X0
RS422 (ASCII)	half-duplex	full-duplex
RS422 (Modbus RTU)	half-duplex	full-duplex
Ethernet (Modbus TCP)	yes	yes
Ethernet (TCP)	yes	yes
Digital in	yes	no
ProfiNET	yes **	yes **
Ethernet/IP	yes **	yes **
EtherCAT	yes **	yes **

** optional, 2D/3D Gateway is required

Note: For further information on loading user modes please refer to the document "Manual scanCONTROL (Part B)"

Note: scanCONTROL Configuration Tools provides the possibility of loading user modes. To do this, either select the menu item "Parameters → Load parameters from scanCONTROL" or press the corresponding button (see Fig. 3.59) in the "General" toolbar (see Chapter 3.14.5).

Note: The "Digital input resistor" parameter (see Chapter 3.9, "Interface" tab) is not considered when loading parameters from the scanCONTROL measuring system.

8.3.1 Loading of User Modes using the RS422 Port (ASCII)

Configuration of the RS422 port:

- **Data bits:** 8
- **Parity:** none
- **Stop bits:** 2
- **Flow control:** none
- **Baudrate:** adjustable, see Chap. 3.9

Please use the following commands:

- **Load user mode:** Use the following command in order to load an user mode:

```
setq 0xf0f00624 0x[User mode no.]0000000
```

Example: Use the following command in order to load user mode 2:

```
setq 0xf0f00624 0x20000000
```

- **Get the actual user mode no.:** Use the following command in order to retrieve the number of the user mode currently used:

```
getq 0xf0f00624
```

scanCONTROL Smart replies as follows:

```
#q 0xf0f00624 0x[User mode no.]0000000
```

Note: Specify [User mode no.] in hexadecimal format.

Note: Each command has to be completed using "\r\n".

8.3.2 Loading of User Modes using Modbus

You may use the RS422 port (Modbus RTU) or the Ethernet interface (Modbus TCP) in order to load user modes using Modbus. The commands may be implemented as single write commands or as multiple write commands.

Note: In case of using single write commands the register 32 has to be written last.

Please use the following commands:

- Load user mode: Write the following holding registers in order to load an user mode:

Register	Value	Description
37	0x[User mode no.]000	0x0000 for user mode 0, 0x1000 for user mode 1, ... , 0xf000 for user mode 15
36	0x0000	-
35	0xf0f0	scanCONTROL address for user modes (upper 16 bit)
34	0x0624	scanCONTROL address for user modes (lower 16 bit)
33	0x0000	-
32	0x0002	Corresponds to "setq"

- Get the actual user mode no.: Write the following holding registers in order to retrieve the number of the user mode currently used:

Register	Value	Description
35	0xf0f0	scanCONTROL address for user modes (upper 16 bit)
34	0x0624	scanCONTROL address for user modes (lower 16 bit)
33	0x0000	-
32	0x0003	Corresponds to "getq"

The user mode currently used is available at the register 37 now
(Format: 0x[User mode no.]000, e.g. 0x2000 for user mode 2).

8.3.3 Loading of User Modes via Ethernet (TCP)

Use a TCP Client (Port 502) in order to load user modes via Ethernet (TCP).

Please use the following command:

- Load user mode: Use the following binary byte sequence in order to load a user mode:

Value	Description
0xf4	Transaction identifier (arbitrary, you may use any number instead of 0xf406)
0x06	
0x00	Protocol identifier (always 0)
0x00	
0x00	Command length
0x13	
0x01	Unit identifier (adjustable: 1 - 247)
0x10	Function code 16 (multiple write command)
0x00	Start register
0x20	
0x00	Number of registers
0x06	
0x0c	Number of bytes
0x00	Corresponds to "setq"
0x02	
0x00	-
0x00	
0x06	scanCONTROL address for user modes (lower 16 bit)
0x24	
0xf0	scanCONTROL address for user modes (upper 16 bit)
0xf0	
0x00	-

0x00	
0x[User mode no.]0	0x00 for user mode 0, 0x10 for user mode 1, ... , 0xf0 for user mode 15
0x00	-

8.3.4 Loading of User Modes using 2D/3D Gateway

You may use the 2D/3D Gateway in order to load user modes via ProfiNET, Ethernet/IP or EtherCAT. The assignment of the Modbus registers 32-37 to the output data on the gateway is a prerequisite.

Please use the following command:

- Load user mode: Write the following output data bytes in order to load a user mode:

Assigned output data bytes	Corr. Modbus-Register	Value	Description
10-11	37	0x[User mode no.]000	0x0000 for user mode 0, 0x1000 for user mode 1, ... , 0xf000 for user mode 15
8-9	36	0x0000	-
6-7	35	0xf0f0	scanCONTROL address for user modes (upper 16 bit)
4-5	34	0x0624	scanCONTROL address for user modes (lower 16 bit)
2-3	33	0x0000	-
0-1	32	0x0002	Corresponds to "setq"

9. Appendix

9.1 Status- and Error Messages, Error Codes

The status line in each of the measuring programs shows a range of status and error messages. The following messages can appear:

Message	Description	Action	Error code
Active: scanCONTROL [Type]([Option])[Version]	No error. Measurement is active.	-	0
Internal error	An unknown error has occurred.	Close Configuration Tools and reset the controller to the default settings by reconnecting the power supply.	-
scanCONTROL-parameters invalid	The parameters transferred to scanCONTROL are invalid.		
Error while data transfer	An error occurred during data transfer.		
No scanCONTROL found	scanCONTROL is not connected to the computer or the power supply of scanCONTROL is switched off.	Check the Ethernet connection and check whether the scanner is switched on and supplied with power. Check the Ethernet cable for defects.	-
No free scanCONTROL found	All scanners connected to the computer are already being used by other programs.	Close the other programs accessing scanCONTROL.	-
scanCONTROL S/N not found	Configuration Tools was last used with a different model of scanCONTROL.	Use the "File → Connect to sensor" menu item to select the current scanCONTROL.	-
scanCONTROL is already in use	The currently used scanner is already used by other programs.	Close the other programs accessing scanCONTROL or use the "File → Connect to sensor" menu item in order to activate another connected scanner.	-
Invalid device	The currently operated device is no scanCONTROL measurement system.	Use the "File → Connect to sensor" menu item in order to select a scanCONTROL device or close Configuration Tools and connect scanCONTROL to the PC.	-
Data transfer interrupted	The data transfer between scanCONTROL and the PC has been interrupted.	Check the Ethernet connection between scanCONTROL and the PC. Check the Ethernet cable for defects. Close Configuration Tools, reconnect scanCONTROL to the PC and restart the software.	-
Inconsistent: No. of profiles too high	The selected value for the parameter "No. of profiles" is too high. Please refer to Quick Reference scanCONTROL to get more information.	Decrease the value for the parameter "No. of profiles".	-

Inconsistent: No. of profiles too high for evaluation	The selected value for the parameter "No. of profiles" is too high for evaluation of the measurement.	Decrease the value for the parameter "No. of profiles" or decrease the number of measured values output via analog/digital/RS422/ethernet interface or decrease the number of active measuring programs.	-
Inconsistent: Exposure time / No. of profiles	The selected scanner settings "Exposure time" and "No. of profiles" are mutually exclusive.	Type in consistent values for the parameters "Exposure time" and "No. of profiles" (see Chapter 3.7).	-
Inconsistent: Measuring field / No. of profiles	The selected scanner settings "Measuring field" and "No. of profiles" are mutually exclusive. Please refer to Quick Reference scanCONTROL to get more information.	Type in consistent values for the parameters "Measuring field" and "No. of profiles".	-
Inconsistent: Points per profile / No. of profiles	The selected scanner settings "Points per profile" and "No. of profiles" are mutually exclusive.	Type in consistent values for the parameters "Points per profile" (see Chapter 3.9 tab "General") and "No. of profiles" (see Chapter 3.7).	-
Inconsistent: Serial out / No. of profiles	The profile frequency set is too high for the transmission of measurement data via the RS422 interface.	Reduce the value for the parameter "No. of profiles" (see Chapter 3.7) or alter the parameters of the RS422 interface or reduce the number of measured values transmitted (see Chapter 6.4).	-
Inconsistent: Serial out / Length of output string > [...] characters	The number of characters supplied at the RS422 port is too high.	Decrease the number of measured values supplied at the RS422 port (see Chapter 6.4).	-
Inconsistent: UDP out / Length of output string > [...] characters	The number of characters transferred via Ethernet (UDP) is too high.	Decrease the number of measured values output using UDP or bundle size (see Chapter 6.5).	-
Inconsistent: Modbus out / No. of registers	The number of available modbus registers is exceeded.	Decrease the number of measured values supplied via modbus. (see Chapter 6.6)	-
Inconsistent: Gateway out / No. of registers	The number of available gateway registers is exceeded.	Decrease the number of measured values supplied via gateway. (see Chapter 6.7)	-
Inconsistent [...]	The shown scanner parameters [...] are mutually exclusive.	Type in consistent values for the shown parameters [...].	-
Couldn't create display of ring buffer	The loading of profile sequence for the ring buffer display takes too long and is canceled.	Copy the profile sequence to your PC local and load them again.	-
Corrupt profile	The transferred profile is corrupt.	Deactivate the filter or reset the parameters to the default settings.	-
Calculation exposure time in progress	Calculation exposure time in progress.	-	-

No points in region of interest	There are no measuring points in the range defined for profile evaluation (Cut).	Enlarge the range for profile evaluation (Cut). Change the distance to the object to be measured. Increase the exposure time.	10
Too few points for the gap	There are no measuring points in the range defined for profile evaluation (Cut).	Enlarge the range for profile evaluation (Cut). Change the distance to the object to be measured. Increase the exposure time.	10
Too few points for the circle	There are no measuring points in the range defined for profile evaluation (Cut).	Enlarge the range for profile evaluation (Cut). Change the distance to the object to be measured. Increase the exposure time.	10
Anchor point couldn't be detected	An error has occurred while calculating the anchor point.	Check the settings of the measuring program providing the anchor point.	11
Too few points for reference	There are not enough measuring points in the reference ranges for the calculation of a reference line/auxiliary line.	Enlarge the reference range (reference lines).	20
Parallel reference lines, no intersection point	An intersection point couldn't be calculated as the reference lines are parallel.	Check the areas for line fitting.	21
Intersection point out of range	The calculated intersection point is outside the range to be displayed.	Check the areas for line fitting.	22
Too few points for Seam	There are not enough measuring points in the profile section search range.	Enlarge the profile section search range (Seam, Groove and Edge).	30
Too few points for Groove			
Too few points for Edge			
Seam not found	No profile section was found.	Check the minimum height for the detection of the profile section.	31
Groove not found			
Edge not found			
Surface Maximum not found			
Surface Minimum not found	The vertex of the measured circle is outside the value range	Check the settings for the detection of the profile section.	31
Vertex not found			
Seam width too small	The width of the found profile section is too small.	Check the settings for the detection of the profile section.	32
Groove width too small			
Edge width too small			

Invalid sensor type for circle measurement	The circle measurement is only available when using a scanCONTROL 30XX measurement system.	Use the "File → Connect to sensor" menu item in order to select a scanCONTROL 30XX measurement system.	-
Filter x: Invalid sensor type for minimum/maximum Filter	The minimum/maximum filter is only available when using a scanCONTROL 30XX (firmware version ≥ 50) measurement system.		
Invalid sensor type for circle seam/groove measurement	The circle seam/groove measurement is only available when using a scanCONTROL 30XX (firmware version ≥ 52) measurement system.		
Invalid sensor type for user mode output	The user mode measured value is only available when using a scanCONTROL 30XX (firmware version ≥ 52) measurement system.		
Invalid sensor type for bundled output	The output of the bundled measured values is only available when using a scanCONTROL 30XX (firmware version ≥ 54) measurement system.		
No reference program selected	For the circle seam/groove measurement a circle reference program is required.	Add a circle measuring program before the current measuring program and select this as a reference program.	-
Filter memory overflow	The number of required filter registers is too high.	Decrease the filter size or the number of filtered signals (see Chapter 6.1).	-
Too much parameters for evaluation	The number of required parameters of the active measuring programs is too high.	Decrease the number of measured values supplied at the analog/digital/RS422 port or decrease the number of measuring programs.	-
Too few points for evaluation	The number of points per profile is too small in order to evaluate the measurement.	Increase the number of points per profile or decrease the number of measuring programs.	-
Error combined signal x	An error has occurred while calculating a combined signal.	Open the "Result combination" view (see Chapter 5) and check the settings of the respective combined signal x ($x = 1..8$).	-
Invalid firmware for [...]	The firmware of scanCONTROL doesn't support the desired feature [...].	Please refer to the contact address printed on the inside cover of this manual.	-
Missing "SI" option for laser measurement value	The output of the laser state is only possible with a safety lock (option "SI").		
A Gigabit Ethernet connection is required	When using the "Display Image Data" program scanCONTROL 29X0/30X0 requires a Gigabit Ethernet connection.	Use a Gigabit Ethernet interface.	-
Loading profiles	The profile sequence is being loaded in the RAM (Offline mode).	Wait until the profile sequence has been completely loaded.	-
Ready	The system is ready to play the loaded profile sequence (Offline mode).	Press the play button in the "File settings" input field (see Chap. 3.10) to play the profile sequence.	-

Play: scanCONTROL [Type]([Option])[Version]	No error. A profile sequence is being played (Offline mode).	-	-
Couldn't open file	The specified name or path was incorrect.	Select the correct directory containing your recorded profile sequence.	-

Note: In the Result Combination view an error code is generated for all combined signals. This value can be output at different outputs (see Chapter 6). The error code is coded bitwise, whereby the order of assignment to the combined signals is from the least significant bit to the most significant bit. If the respective bit is set, an error has occurred in the corresponding combined signal. Example: Value 18 = 10010 in binary representation: The second and fifth combined values are incorrect, the others are error-free.

9.2 Notes and Tips on Using scanCONTROL

Please note the following when operating the scanCONTROL Configuration Tools.

- 1 Never disconnect the connection between scanCONTROL and the PC while using the software. Never disconnect the power supply of scanCONTROL while the software is running.
This may cause the software to shut down unintentionally.
- 2 The measuring programs show the saturation in the "Scanner settings" input field. This is greatly influenced by the exposure time and affects the way in which the profile data are calculated. The saturation should be between 70 % and 90 % during a measurement.
- 3 There may be a discrepancy between the setpoint value and the actual value for the no. of scans per second if the number of scans is set too high or the processing power of the PC is insufficient.
- 4 The "Exposure time" parameter in the "Scanner settings" input field specifies the exposure time for the scanner. The value is also influenced by the "No. of profiles" parameter. The actual value of "No. of profiles" has priority over the "Exposure time" parameter. This results from the inequality $1/(\text{No. of profiles}) \geq (\text{Exposure time})$. This means, for example, with the setting "Exposure time [ms]: 10" and "No. of profiles [1/s]: 200" the "Exposure time" value is adjusted. The new value for the "Exposure time" parameter is 5 ms.
- 5 Save the actual parameters before you start to record a profile sequence. You can then load them again before you play back the profile sequence.
- 6 Select the ? → Help menu item or press the <F1> key directly in a measuring program to display help information about that measuring program.
- 7 Proceed as follows if you cannot see a profile in the "2D-display" and no error messages are displayed in the status line: Restore the default settings via the "Parameters → Reset..." menu entry. Valid parameters are now loaded into the "Scanner settings", and the complete measuring range is displayed in the "2D-display".
- 8 The Configuration Tools CD contains examples of profile sequences in the directory "[CD]:\Examples".

9.3 Key Shortcuts

Use key shortcuts to work faster! The following shortcuts are available:

Key combinations	Action
F1	Open the online help for the current view
Ctrl + F5	Toggle pause mode
F5	Transfer a current profile from the scanner when pause mode activated
Ctrl + F1	Online mode
Ctrl + F2	Offline mode
Ctrl + F3	Save profile
Ctrl + F4	Save profile from the ring buffer
Ctrl + F6	Activate/Deactivate protocol results
Alt + R	Activate/Deactivate saving profiles (Program "Save Profiles", see Chapter 4.11.3)
Ctrl + O	Load parameters from file
Ctrl + S	Save parameters to file
Ctrl + R	Reset parameters
Ctrl + Alt + O	Load parameters from scanCONTROL
Ctrl + Alt + S	Save parameters to scanCONTROL
Ctrl + F7	Adjusting basic settings
Ctrl + F8	Adjusting scanCONTROL Network Settings

Note: In case of a malfunction of some key shortcuts please check if these shortcuts are used by other programs.



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